Rotoiti Nature Recovery Project Annual Report 2014-15

Nelson Lakes Mainland Island, Nelson Lakes National Park

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Te Papa Atawhai

Cover: Pīhoihoi/New Zealand Pipit (*Anthus novaeseelandiae*) in East Sabine valley.
Photo: Gareth Rapley.

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Executive summary

The objectives of the Rotoiti Nature Recovery Project (RNRP) altered following the implementation of the 2014-19 RNRP Strategic Plan (Harper & Brown, 2014). The new objectives retain the same fundamental aims as previous ones, but reflect changes that have occurred since the last Strategic Plan was published in 2008, such as the change in the Department of Conservation (DOC)'s strategic direction to one with an increased focus on fostering partnerships to achieve conservation goals.

Biodiversity restoration objectives

Restore and maintain populations of kea (*Nestor notabilis*), kākā (*Nestor meridionalis*), mistletoe (*Alepis flavida* and *Peraxilla* spp.), *Pittosporum patulum* and a *Powelliphanta* sp. snail

In 2014 the RNRP experienced the heaviest beech mast since its inception in 1996. This mast was widespread across the South Island, leading to DOC's national Battle For Our Birds (BFOB) landscape-scale pest control programme in response, which aimed to protect threatened native fauna from the anticipated rodent and mustelid plagues that would follow the heavy mast. The core and lake-side sections of the RNRP and surrounding areas in the Travers and East Sabine catchments were treated with either aerially-applied or hand-broadcast 1080 in order to prevent severe predation of vulnerable native species such as kea, kākā and great spotted kiwi. The successful completion of this BFOB operation could potentially mark the beginning of a new period of truly landscape-scale pest control in the RNRP.

One active kea nest was protected using a small intensive trap network this year, and one nest was within the BFOB aerial 1080 treatment area. The nest protected by traps successfully fledged three chicks. The nest within the BFOB treatment area had a first clutch fail due to predation prior to the aerial operation. Following the aerial operation a second nesting attempt was successful at fledging three chicks despite the adult female being killed by 1080 poisoning. A diversion area method was tested for mitigating the threat to ski field kea from the 1080 operation. The monitored ski field kea all survived the operation.

The kākā encounter rate this season was significantly lower than in 2013/14, but similar to that in 2012/13 and earlier years. The high 2013/14 encounter rate was likely caused by abundant beech flowering stimulating kākā activity rather than an actual increase in population. No nest monitoring occurred this year, but a pair of kākā were observed feeding two fledglings on the St Arnaud Range track, indicating that at least some kākā bred successfully.

No monitoring of mistletoe took place this year. *Pittosporum patulum* monitoring was intended to be done to provide information on any effects of the BFOB operation, however staff time constraints prevented this from being completed and full monitoring will take place in 2017.

Monitoring results of the *Powelliphanta* "Nelson Lakes" snail population in the alpine zone at the northern end of the St Arnaud Range indicate that the population is small and still declining. It was intended that the BFOB operation would treat the area inhabited by this population to provide protection from predation, but changes resulted in this site being outside the treated area.

Establish and maintain populations of whio (*Hymenolaimus malacorhynchos*), great spotted kiwi (*Apteryx haastii*), rock wren (*Xenicus gilviventris*) and other native species

Two more kiwi have been added to the reintroduced population in 2014/15, both from the Stockton Mine Operation Nest Egg programme. Both have since gained weight. Breeding activity was only observed in one monitored kiwi this year, but this nesting attempt failed for unknown reasons.

No attempt at re-establishing populations of whio or rock wren has been made this season, but doing so remains a goal for the future. A small but increasing number of whio are now regularly seen at Blue Lake, which, if protected by landscape-scale pest control in the future, could eventually provide a source population to recolonise the Travers catchment.

Learning objectives

Test the effectiveness of control methods for stoats (*Mustela erminea*), rats (*Rattus* spp.), cats (*Felis catus*), possums (*Trichosurus*

***vulpecula*), wasps (*Vespula* spp.) and other potential pest species in a beech forest and alpine ecosystem**

The last of the self-resetting A24 traps were removed in July 2014, with the pre-existing DOC-series trap network fully re-activated. While the aforementioned BFOB operation did not explicitly target stoats, it was expected that it would prevent a stoat plague firstly by limiting the rat plague that would otherwise fuel a stoat plague, and secondly by killing stoats via secondary poisoning.

The BFOB operation was the first aerial 1080 rat control operation to be carried out in the RNRP. A trial was done to compare results between areas treated with two different swath widths for aerially-broadcast bait. The results from this trial were not conclusive, but indicate that factors influencing bait distribution such as swath width might indeed be having an impact on the overall success of aerial 1080 operations.

Cat control was done using raised-set kill traps and live-capture cage traps, with more effort put into cat trapping in 2014/15 than in previous years. The use of recycled bird transmitters for remote monitoring of cage traps was trialled, initial results were promising but more work needs to be done before this system could be considered reliable.

Possums were a secondary target of the BFOB operation, with waxtag monitoring results and trap-catch results from the Travers Valley possum trap lines indicating that the operation successfully reduced possum numbers significantly in the treatment area, which will help limit reinvasion pressure to the RNRP Core Area from the south. Possum trapping continued in other RNRP areas as in previous years, with waxtag monitoring results indicating that possum numbers in the RNRP have been kept low.

The RNRP wasp control area was extended this year to the southern end of Lake Rotoiti. The control operation was once again successful in reducing wasp flight counts and increasing honeydew droplet abundance. No significant difference in results was found between a 400×50m and a 300×50m bait station grid.

Maintain long-term datasets on bird abundance and forest health in response to ongoing management and predator population cycles

A full set of five-minute bird counts was not able to be completed in 2014/15 due to the BFOB operation taking priority when it came to allocating staff resources. Collecting data for, and analysing, this long-term dataset should be given more priority in the future, with experienced university students a potential untapped source of data gatherers.

Beech seeding was monitored using shotgun sampling and seedfall trays. Following the extreme mast of 2014, it appears that there will not be a mast in 2015, with very little seed being present for all three beech species.

Alpine tussock seeding was monitored using two different monitoring methods for a fourth year to allow a reliable comparison of the methods, with the aim of continuing only with the most efficient one in the future. Very little tussock seed was observed, indicating that there will not be a tussock mast in 2015.

No vegetation plot monitoring was scheduled for 2014/15.

Record observations of previously unreported native and non-native species in the RNRP area

One new species appeared on Lake Rotoiti in 2014/15; a male mandarin duck (*Aix galericulata*) which arrived over winter 2014 and has become resident in the vicinity of St Arnaud, most frequently seen at Kerr Bay on Lake Rotoiti.

Facilitate research to improve our understanding of the ecology and management of beech forest, alpine and wetland ecosystems

Chris Niebuhr (University of Otago), spent a third and final field season collecting data in the RNRP towards a PhD on avian malaria.

Analyse and report on the effectiveness of management techniques, and ensure that knowledge gained is transferred to the appropriate audiences to maximise conservation gain

Other than this report, only a DOC Science and Capability progress report on the self-resetting trap trial was produced, which included an analysis and summary of data collected on the A24 traps over the previous two years in the RNRP. An article in Wilderness magazine featured comments from the local Biodiversity Senior Ranger on wasp control and trials that took place in the RNRP.

Community objectives

Foster relationships with likely partners to produce conservation gains within both the Mainland Island and the local area

Pre-existing relationships have been maintained and developed with local iwi, the Friends of Rotoiti, the Kea Conservation Trust and the Rotoiti Lodge.

Increase public knowledge, understanding and support for mainland islands and ecological restoration nationally through education, experience and participation

Revive Rotoiti was not produced during 2014/15, and local DOC staff are looking into alternative options to effectively tell interested people and groups about the conservation achievements in the RNRP in the future.

A range of public advocacy has continued through the year, including displays and talks at public events.

1. Introduction

The Rotoiti Nature Recovery Project (RNRP) is a Mainland Island project that was established in 1996 to enable the recovery of a representative portion of an alpine honeydew beech forest ecosystem at Lake Rotoiti in Nelson Lakes National Park.

The project began with infrastructure development and baseline monitoring across 825 ha of forest on the western St Arnaud Range. Comprehensive pest control began in 1997. The project was established with treatment and non-treatment sites, so that responses to management techniques at Lake Rotoiti could be compared with the non-treatment site at nearby Lake Rotoroa. The first Annual Report covered the 1997/98 business year.

South Island kākā (*Nestor meridionalis meridionalis*) have been a key focus since the beginning of the project. Staff from the Department of Conservation's (DOC's) former Science and Research Unit (now the Transformation and Threats Unit of the Science and Policy Group) put considerable effort into radio-tracking kākā and monitoring nesting success in response to mustelid (stoat *Mustela erminea*, ferret *M. furo* and weasel *M. nivalis*) control. Kākā nesting success improved considerably and adult female mortality declined as a result of predator control when treatment sites were compared with non-treatment sites (Moorhouse et al. 2003).

In 2001/02, the extent of mustelid trapping was increased considerably, so that over 5,000 ha on the western St Arnaud Range and southern Big Bush is now under sustained mustelid control as part of the Mainland Island. Trapping is also carried out by a local volunteer group, Friends of Rotoiti (FOR), in adjacent areas, encompassing an additional 5,000 ha. Trapping has historically been done using Fenn mkVI then DOC-series traps, however the RNRP was one of the sites involved in a national trial of self-resetting traps for landscape-scale pest control over 2012-2014, specifically testing use of the Goodnature Ltd A24 trap to target stoats. In the RNRP the A24s were not successful at controlling stoats below the target tracking rate and therefore the DOC-series traps were reinstated in 2014.

Management of great spotted kiwi (GSK; *Apteryx haastii*) began in 2004 with the introduction of adult individuals from Gouland Downs in Kahurangi National Park. Additional introductions since then have ensured the successful establishment of a population. Some limited breeding has taken place over the past eleven years, and nine wild-raised kiwi chicks are known to have fledged, despite their known vulnerability to mustelid predation. Over recent years, GSK management has focused on using the Operation Nest Egg™ (ONE) operation to attempt to overcome the poor breeding success of GSK in the RNRP. However ONE has not proven to be particularly successful overall for GSK at this site, with six of thirteen released ONE chicks known to have died, the three that are still monitored known to be alive and the status of the remaining seven unknown. By contrast, all adults or experienced juveniles released have survived and remained within the RNRP protected area. The ONE programme has now ceased.

Kea (*Nestor notabilis*) nest protection was initiated in spring 2011 at three nest sites in partnership with the Kea Conservation Trust (KCT), one within the RNRP's intensive pest control area, two outside this area. With ongoing support from the KCT the number of nests and extent of protection around nests has been increased, with six nest sites currently protected. Despite removing considerable numbers of pests, nests protected in this way can still fail due to predation, supporting the need for landscape-scale pest control to protect vulnerable species. Unfortunately kea are one of the more at-risk species from aerial 1080 operations, therefore the RNRP collaborated with the KCT to trial a proposed mitigation method during the 2014 Battle For Our Birds (BFOB) aerial 1080 operation, the first such operation to take place in the RNRP.

The RNRP has been a leader in the large-scale control of introduced wasps (*Vespula* spp.). Under an experimental use arrangement, historically with Landcare Research—Manaaki Whenua and more recently with the Nelson-based company Entecol, the Mainland Island has been used as a trial site. Experiments have been undertaken with various toxins, particularly Fipronil. The spacing and configuration of bait stations and the development of effective monitoring methods have been the focus of RNRP research over recent years. However, the RNRP has also since late 2013/14 supported Landcare Research in its investigation into the potential of a newly-discovered wasp mite as a biocontrol agent, by collecting queens hosting the mite for analysis.

Rodent (rat *Rattus* spp. and mouse *Mus musculus*) control has had a chequered history in the Core Area of the Mainland Island. Initially, ground-based operations using brodifacoum and 1080 were effectively used to control rodents, particularly rats, between 1997 and 2000. However, after a DOC review of the use of brodifacoum, there was a switch to snap-trapping at a density of one trap per hectare, which proved ineffective at controlling rat populations. The first rat control toxin operation in over four years was carried out in the spring of 2010, covering 600 ha of the Core Area using diphacinone in bait stations. Following initial success, successive operations were extended to cover almost 1,000 ha. Over the 2010-2013 period, these operations had mixed success for environmental and operational reasons that are not yet clear. In 2014 the RNRP experienced its heaviest beech masting event since records began, with similar heavy masting widespread over the South Island. This led to a national DOC response in the form of the BFOB programme, which involved carrying out pest control over the largest area in DOC's history, primarily using aerially-applied 1080. One of the BFOB operations was carried out in Nelson Lakes National Park, covering a large part of the RNRP and extending up the Travers and East Sabine catchments. Whether or not aerial pest control becomes the norm in the RNRP in the future remains to be seen. The continued use of five-minute bird counts and South Island robin (*Petroica australis australis*) monitoring provides an outcome measure for rodent control.

The RNRP continues to trap feral cats (*Felis catus*) using cage traps, although trapping effort varies between years. Trials with Timms traps on raised sets are ongoing, as well as experimentation with using recycled bird transmitters to check live-capture traps remotely, which could greatly decrease the effort required to carry out cage trapping. The trapping of possums (*Trichosurus vulpecula*) using Sentinel kill traps has continued, with a sharp drop in possum catches along the Travers Valley trap lines being observed following the aerial 1080 BFOB operation, indicating it was successful in reducing possum numbers in the Travers Valley, which should minimise reinvasion pressure to the core RNRP for some time. Other pest species under management include red deer (*Cervus elaphus scoticus*) and pigs (*Sus scrofa*).

The response of browse-sensitive plants to pest control has also been monitored. Three species of beech mistletoe, (*Peraxilla colensoi, P. tetrapetala* and *Alepis flavida*), continue to respond positively to possum control with levels of possum browse decreasing and overall plant health increasing in the five-year period between the 2008 and 2013 surveys. However, the critically threatened understorey plant *Pittosporum patulum* is not responding to current management, probably due to it being preferentially browsed by red deer. Beech seedfall and *Chionochloa* tussock flowering are monitored as ecological drivers of rodent and subsequent mustelid population increases, and 20×20 m vegetation plots are monitored to determine the trends and responses of native vegetation to multi-species pest control.

Invertebrate monitoring has included *Powelliphanta* "Nelson Lakes" snails, as well as beech scale insects and honeydew production because of their importance as ecological drivers in the honeydew beech forest ecosystem.

In addition to the core work undertaken by RNRP staff and volunteers, students also conduct research in the Mainland Island. This adds to our understanding of the functioning of the alpine beech forest ecosystem and can inform changes to threatened species and pest control management. During 2014/15 Chris Niebuhr, a PhD student from the University of Otago studying the role avian malaria may be playing in native bird declines, carried out a third and final season of fieldwork in the Mainland Island with some support from RNRP staff.

The involvement of the local and wider community in the RNRP is essential for the success of the project. Maintaining and developing strong positive relationships with partners such as FOR, KCT and the local iwi are a fundamental focus of RNRP staff. Hundreds of days of work in support of the project over the past nineteen years have been undertaken by volunteers, including members of FOR, RNRP volunteers, Nelson Marlborough Institute of Technology Trainee Rangers, Hot Shots and Conservation Corp crews and the Over-50s tramping club. RNRP staff have also given time to other DOC and community initiatives, and have attended workshops and conferences to transfer knowledge to the wider community. Advocacy has included presentations to many school and community groups, guided walks, displays in the Nelson Lakes Visitor Centre, information panels within the Mainland Island, and various printed media. Many events and achievements from the RNRP have also been picked up by local and national media, including the area being listed as one of the Top twenty-five Ecological Restoration Sites in Australasia in 2008 (Brown & Gasson, 2008).

Following DOC's change in strategic direction in late 2013 to one with an increased focus on fostering partnerships to achieve conservation goals, a new RNRP Strategic Plan 2014-19 (Harper & Brown, 2014) was implemented in April 2014, replacing the previous RNRP Strategic Plan 2008-13 (Brown & Gasson, 2008). The objectives of the new plan retain the same fundamental aims as the previous one, but reflect the increased focus on creating and developing partnerships outside of DOC.

Although day-to-day work in the RNRP progresses in response to annual or multi-annual ecosystem cycles, no operation of this scale can operate without a vision and objectives to provide guidance in the medium term. To this end, the RNRP Strategic Plan 2014-19 provides the planning framework and goals for the operation and highlights three major themes composing the overall goal of the project, namely:

1. Increasing our knowledge of how to carry out ecological restoration nationally, while restoring local biodiversity and retaining the biodiversity gains achieved thus far

2. Advocating the value of ecological restoration to the public leading to increased public support

3. Create new, and develop existing, partnerships in order to achieve greater conservation goals

It is essential that these themes remain the core values for ongoing work within the Mainland Island into the future. A Technical Advisory Group and external advisors play an important role in overseeing and guiding these themes.

Additional information pertaining to this project, including datasets, advisors and project management details can be found in Appendices 1-3.

2. Biodiversity restoration objectives

2.1 Restore and maintain populations of kea, South Island kākā, three beech mistletoes, *Pittosporum patulum* and a *Powelliphanta* snail

2.1.1 Introduction

Kea (*Nestor notabilis*), South Island kākā (*Nestor meridionalis meridionalis*), three species of beech mistletoe (*Peraxilla colensoi, P. tetrapetala* and *Alepis flavida*), *Pittosporum patulum* and the carnivorous land snail *Powelliphanta* "Nelson Lakes" are seven threatened species identified in the RNRP strategic plan 2014-19 (Harper & Brown, 2014) as having been present at Rotoiti prior to the establishment of the RNRP. Although there are further threatened species in the RNRP that may benefit from pest control, these populations were specifically identified because all except the kea have had considerable effort put into the restoration of their populations within the RNRP since its inception.

Kea, the only truly alpine parrot in the world, were not included in previous strategic plans. This has now been changed due to the fact that the species forms an integral part of the South Island alpine ecosystem, and the fact that the status of kea was changed from 'naturally uncommon' to 'nationally endangered' in 2013 (Robertson et al. 2013). There has been evidence of a continuing slow decline in kea numbers in Nelson Lakes National Park (Steffens & Gasson 2009, Harper et al. 2011), with predation by the introduced brushtail possums (*Trichosurus vulpecula*) and stoats (*Mustela erminea*) on kea nestlings and incubating adults the primary threat. Localised stoat and possum control has therefore been put in place around a number of nests that lie outside the RNRP's intensive pest control area, and other threats such as lead flashing and nails in DOC huts are planned to be addressed. An aerial 1080 operation was carried out over part of the RNRP for the first time in 2014 as part of DOC's national Battle For Our Birds (BFOB) programme, therefore extra monitoring and mitigation measures were put in place to minimise the risk to kea of ingesting poison baits.

The kākā is an endemic forest parrot which is threatened by predation. Stoats are the main predator of kākā, but all three introduced mustelids (stoats, ferrets and weasels) are targeted by mustelid control. Mustelid trapping has been shown to protect the local kākā population (Moorhouse et al. 2003), and will continue for the foreseeable future. An upgrade from Fenn MkVI traps to DOC200 and DOC250 traps commenced in 2007 and was completed in late 2009. A two-year trial of A24 self-resetting traps took place over 2012-2014, after which the DOC-series traps were reinstated. In December 2014, the BFOB aerial 1080 operation was carried out in response to the heaviest beech mast experienced since the project's inception, with the intention of preventing a beech seed-fuelled rat population irruption followed by a stoat irruption which would otherwise threaten kākā and other native species. Feral cat control, although only carried out over a small area to date, may protect fledging kākā chicks which spend up to three days on the ground between emerging from their nest holes and being able to fly. Other native bird species present are likely to benefit from this predator control, particularly great spotted kiwi (*Apteryx haastii*) and kārearea/New Zealand falcon (*Falco novaeseelandiae*), which nest on the ground.

The beech mistletoes, *P. patulum* and the snail *Powelliphanta* "Nelson Lakes" are all threatened as a result of predation by the brushtail possum. Possum numbers have been reduced and suppressed within the RNRP, mainly through a sustained trapping programme. The aerial 1080 operation in late 2014 suppressed possum numbers very effectively further up the Travers Valley where there had historically been no possum control, which will reduce reinvasion pressure to the RNRP from the south. Possum control is considered to be effective at protecting these species and will continue for the foreseeable future.

In addition to being threatened by possums, *P. patulum* and *Powelliphanta* "Nelson Lakes" populations may be threatened by red deer (*Cervus elaphus scoticus*). Detrimental browsing of juvenile *P. patulum* plants has been attributed to red deer. Red deer may deleteriously impact *Powelliphanta* habitat through concentrated browsing and trampling in the mountain beech/tussock ecotone that is favoured by both deer and *Powelliphanta* "Nelson Lakes". Deer control is currently not a regular part of the RNRP pest control programme, but has been supplemented by the initiation of limited access to the RNRP for recreational hunters in May 2010, principally through local NZ Deerstalkers' Association branch members in a volunteer capacity. Hunters are allocated one of four blocks within the area and all animals shot are recorded. Another probable problem species for high montane/ alpine species are hares (*Lepus europeaus*) that degrade habitat through browsing, and pigs (*Sus scrofa*) are known to be present in the vicinity of the snail colony, their rooting activity also degrading snail habitat. Regular hare and pig control has not yet been implemented in the RNRP.

2.1.2 Rotoiti Battle For Our Birds operation

2.1.2.1 Introduction

The Battle For Our Birds (BFOB) was a national-level DOC pest control programme announced on 29th January 2014, implemented in response to the significant beech mast that occurred widely throughout the South Island in 2014. This mast event was predicted to drive rat and subsequently stoat irruptions in the beech forests, wreaking havoc on native fauna. More information on BFOB at a national level can be found on the DOC website www.doc.govt.nz/our-work/battle-for-our-birds.

Rotoiti was not included in the initial list of planned BFOB sites to receive aerial 1080 (sodium fluoroacetate) treatment due to the potential for such an operation to undermine the existing self-resetting trap trial. However, this trap trial ceased earlier than was originally planned (see Long et al. 2015), which enabled Rotoiti to be added to a list of reserve BFOB sites that would be treated if some sites on the original list did not end up experiencing a mast event and therefore were not in need of aerial pest control.

Ultimately, Rotoiti had the highest red and mountain beech seeding out of all sites measured by shotgun sampling in 2014 (J. Tinnemans (DOC), unpublished data in Beech Seed Sampling database) and also had very high levels of silver beech seeding. In terms of energy input into the forest, the mast at Rotoiti was more severe than either of the two other major mast events experienced since the RNRP's inception; those around 2000-2001 that were linked to the local extinction of mohua (yellowhead; *Mohoua ochrocephala*) on Mt Stokes in the Marlborough Sounds, and declines in monitored bird populations in Nelson Lakes National Park.

This, combined with lower masting levels at other proposed sites than predicted by early modelling, meant that in late August 2014 it was decided that Rotoiti would receive funding to carry out a BFOB operation and full preparation was initiated. Preliminary work, such as submitting consent applications to Regional Councils, had already been carried out before it was known whether or not an operation would be funded at Rotoiti, as otherwise there would not have been sufficient time for all the necessary consents to have been received before the operation needed to take place.

Despite the short timeframe in which to prepare, a full-team approach to planning and implementing the operation led to it going ahead without any major incidents. Issues raised during preliminary consultation were addressed during planning, and no complaints were received following the operation.

For further detail about the operation than is in this report, refer to Pestlink report 1415STA02 and the BFOB documents in Appendix 2.

2.1.2.2 Beech seedfall monitoring

Introduction

Beech seed is an important driver of rodent and consequently stoat population dynamics in beech forest. Mast events, where beech seeds are produced in quantities several orders of magnitude higher than in non-mast years, can lead to rodent irruptions and subsequently stoat irruptions, which in turn can have devastating impacts on the nesting success and survival of native birds. It is therefore important to monitor beech seed levels in order to be able to plan and implement the necessary increase in rodent and stoat control effort during mast years.

Methods

There are now several phases in the process of monitoring beech seed in order to inform pest control decisions.

Firstly, modelling is done by scientists in DOC, Landcare Research and the University of Canterbury, using data such as mean summer temperature, to predict many months in advance which areas of beech forest are likely to experience a mast in a given year. While the results of this modelling are indicative only and must be followed up with local monitoring, they are very useful in providing early warning of whether or not a large-scale response to a mast event is likely to be necessary.

Secondly, shotgun sampling is carried out where branchlets are removed from the canopy of beech forest by having the branch shot off from below, and the number of cupules present are counted. This has been done in January in the RNRP since 2012, and provides a more specific local estimate of mast severity. However this estimate is still only indicative as the seeds must mature and fall to the ground before they become available to rodents to fuel a plague, and natural events such as strong winds or heavy frosts can disrupt this process.

Finally, seedfall tray data is collected where the number of seeds that become available to rodents are counted. This has been carried out in the RNRP since its inception, and is conducted within the Core Area of the Mainland Island at Lake Rotoiti and along the Mt Misery track at Lake Rotoroa. Twenty seedfall trays are located at each of the two sites. Collection bags are fitted in early March, these are collected and new bags deployed in mid-April, the second set collected in mid-June. Any seed collected is separated into species, counted and then tested for viability. This monitoring gives the most accurate indicator of the likelihood of a rodent plague, however the results are not available until much later than the other monitoring methods, hence the need for the previously-described methods to give early warning of the need to prepare for a likely pest control operation.

Results

Beech seed monitoring carried out during 2014/15 indicates that there will not be a mast event in 2015 (see figure 1 and table 1), unlike in 2014 when there was a full mast at both Lake Rotoroa and Lake Rotoiti with all three beech species seeding more heavily at Rotoiti than in any year since seedfall tray records began in 1997.

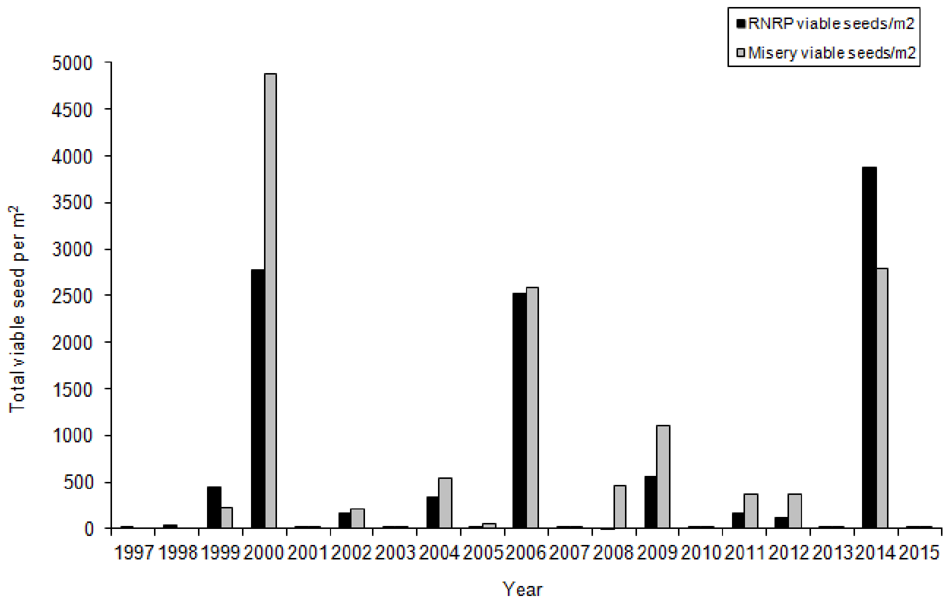


Figure 1. Total viable beech seeds per m² from the RNRP (Lake Rotoiti) and Mt Misery (Lake Rotoroa), over the period 1997-2015.

Table 1. Beech seed counts per m² at Lake Rotoiti and Lake Rotoroa in 2014/15

Site	Count type	Red beech (*Fuscospora fusca*)	Mountain beech (*Fuscospora menziesii*)	Silver beech (*Lophozonia cliffortioides*)
Lake Rotoiti	Total count	75	31	116
	Total viable seed	36	1	37
	% viable	48%	3%	32%
Lake Rotoroa	Total count	73	31	204
	Total viable seed	28	6	39
	% viable	38%	19%	19%

Discussion

The predicted rat and stoat plagues following the record beech seeding observed in 2013/14 did come to pass in 2014/15. For more details on this and the resulting landscape-scale pest control operation implemented, see *section 2.1.2 Rotoiti Battle For Our Birds operation*.

The low level of beech seeding recorded in the RNRP this year indicates that 2015 will not be a mast year, and that therefore a large-scale rodent control operation similar that of 2014/15 will not be necessary in 2015/16.

2.1.2.3 BFOB rodent control and monitoring

Introduction

Beech seed is an important driver of rodent population dynamics in beech forest. Seasonal breeding of ship rats causes corresponding seasonal changes in density. Studies have found heavy seeding of beech species has preceded extended rat breeding seasons, indicating the key role food supply plays in initiating population increases (Blackwell et al. 2003; Dilks et al. 2003).

In upland beech forest, such as that present in the RNRP, ship rats are therefore a periodic threat to forest birds following beech mast events. The greatest threat occurs during the breeding season when eggs, chicks and incubating birds are at risk in the nest (Innes et al. 2010), however, roosting birds and bats are also at risk outside the breeding season (Pryde et al. 2005; O'Donnell et al. 2011).

Ground-based rat control has been carried out in a variety of ways in the RNRP since it was established, with mixed levels of success even during non-mast years (see previous RNRP Annual Reports for details). Given the unreliability of ground-based rat control to suppress rats to the desired level in a non-mast year, it was considered that such methods were very unlikely to be successful in a severe mast year.

Aerial 1080 was chosen as the primary control method used in BFOB operations in 2014 because it has proven effective at controlling rats at the landscape scale during mast-induced rat irruptions (Fairweather et al. 2015). Large-scale operations are also required to achieve the necessary level of protection for species that occur in low breeding densities, such as kea (*Nestor notabilis*) and rock wren (*Xenicus gilviventris*).

Ship rats (*Rattus rattus*), were the primary target of the 2014 Rotoiti BFOB operation. While mice are also known to experience irruptions following mast events, aerial 1080 is not currently approved for explicitly targeting mice. However, a reduction in mouse numbers was expected to be a beneficial side-effect of the operation.

This year was the first time an aerial 1080 operation had been carried out by DOC Rotoiti/Nelson Lakes staff, hence a lot was learnt during the process of planning and carrying out the operation. These learnings have been recorded at a local and national level and will lead to improvements in any future similar operations.

For more detail on the reasoning behind this operation, the receiving environment and target/non-target species, refer to the AEE document (see Appendix 2).

Methods: control

The area treated (the majority of the Travers and the East Sabine catchments, see figure 2) was significantly larger than the existing RNRP ground-based pest control area, demonstrating one of the most clear benefits of aerial pest control over labour-intensive ground-based pest control, and minimising the effects of reinvasion. The Core Area and lakeside extension of the RNRP were within the treatment area, whereas Big Bush was not included, the latter providing an area where only stoat trapping took place for comparison. The Rotoroa non-treatment site was also deliberately not included in the treatment area, in order to continue to provide an untreated area where outcomes can be compared with those of treated areas in order to assess the effectiveness of pest control methods.

Originally it was planned to include alpine areas free of snow within the catchments in the aerial treatment area, to provide protection from predation to a known snail population and other alpine natives. The prefeed operation did treat these areas (see figure 3), but they were removed from the toxic treatment area as a precautionary response to concerns about the impact of 1080 on rock wren populations at a treated site in Kahurangi National Park.

Since the alpine areas were originally intended to be treated with 1080, a project was initiated by DOC together with the Kea Conservation Trust and the Friends of Rotoiti to attempt to minimise the risk to kea, which are known to be one of the more at-risk native species to 1080 poisoning. See *section 2.1.2.7 BFOB kea diversion project* for details of this project.

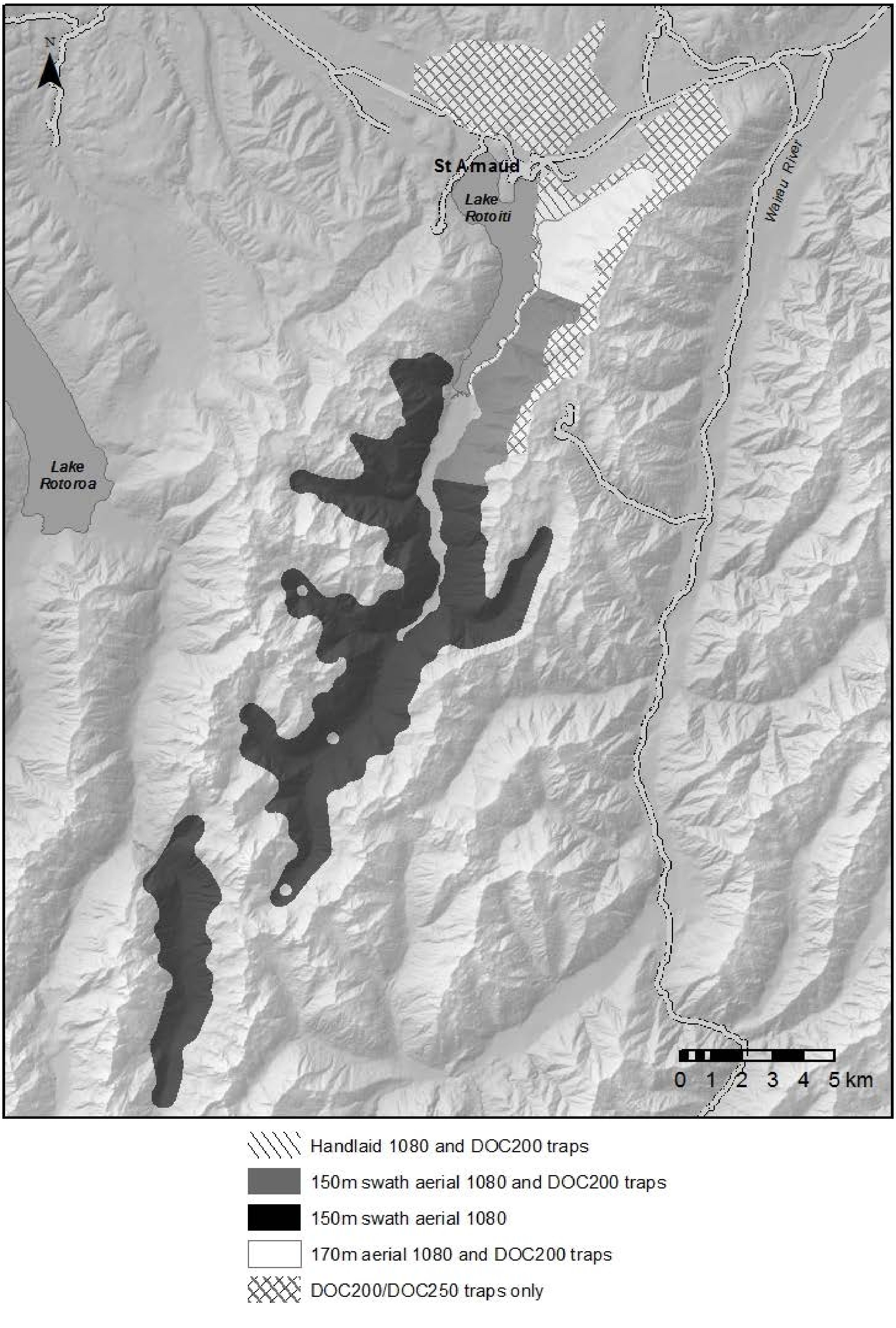


Figure 2. Treatment blocks during Rotoiti Battle For Our Birds pest control operation in 2014. Note circular untreated areas within the block are hut exclusions.

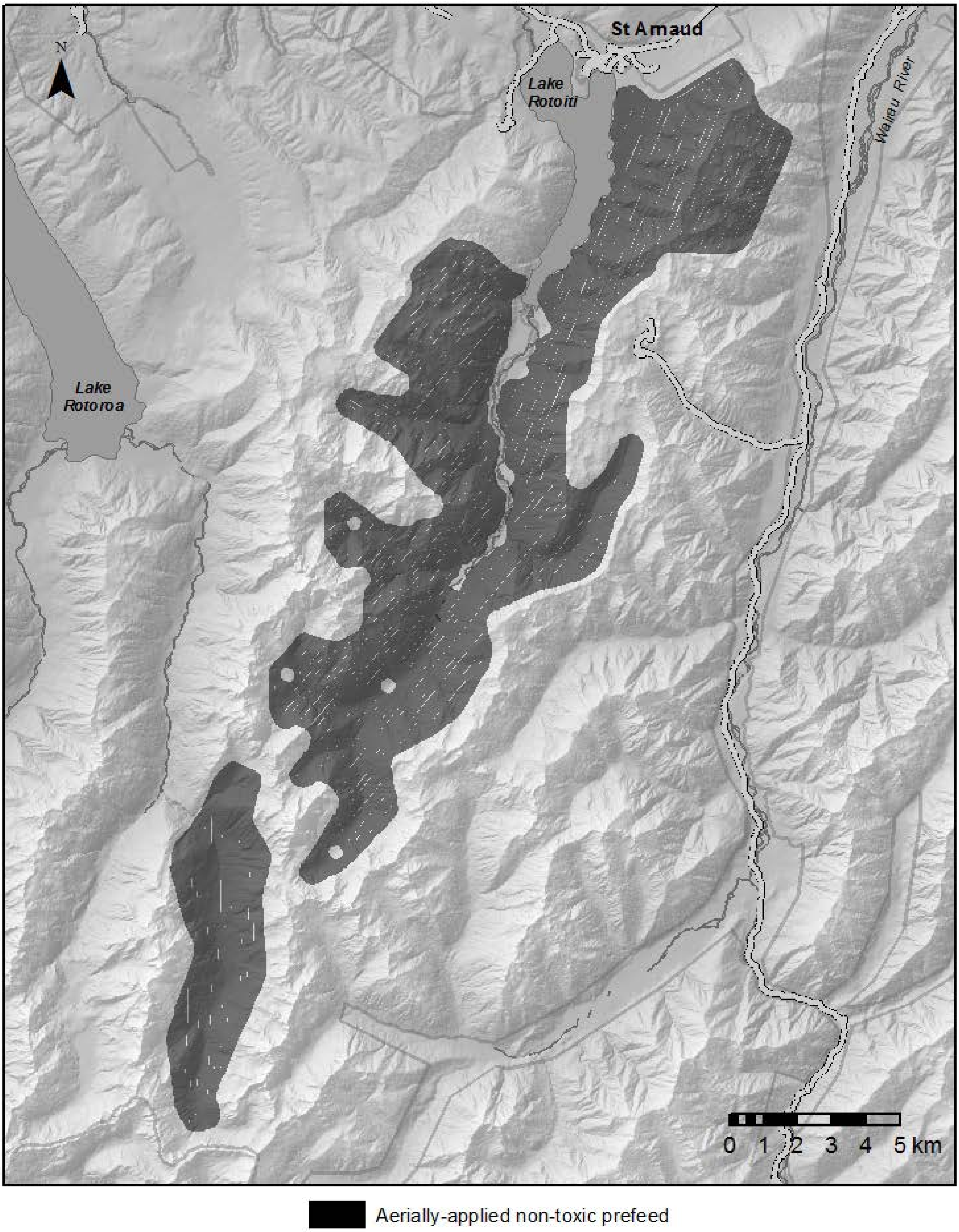


Figure 3. Area treated aerially with non-toxic pre-feed in Rotoiti Battle For Our Birds pest control operation, 2014. Note circular untreated areas within the block are hut exclusions.

The Travers Valley open flats were excluded from the operation in response to concerns of anglers, and 6g pellets were used instead of 12g pellets because the primary target was rats, not possums, and because using 6g pellets minimises the impact on deer which was a concern to hunters. Deer and kea repellents were not used due to proven effective repellents not being available at the time of the operation.

Public walking tracks were closed during the operation, and re-opened after tracks had been cleared of bait, with some tracks being cleared more than once. Huts and hut water supplies were excluded from the treatment area, with exclusion buffers being set by the Public Health Officer. Alternative drinking water was supplied for a minimum of seventy-two hours following the operation.

The caution period for the operation was ended with the Public Health Officer's consent on 15th May 2015, based on the results of bait and carcass monitoring. In addition to this compulsory monitoring, voluntary additional monitoring was carried out; for carcasses along the Borlase farm boundary, and for 1080 residues in water samples from Borlase and Black Valley streams. No detectable levels of 1080 were found in any of the water samples (see Appendix 2 for links to BFOB documentation).

Aerial - Prefeed

The aerially-applied prefeed operation was carried out on 8th November 2014. 6g RS5 cereal pellets lured with 0.3% cinnamon and no dye were used, at a rate of 1 kg/ha. 13,971 hectares were treated with prefeed, all at 170m swath widths (see figure 3).

Aerial – Toxic

The aerially-applied toxic operation was carried out on 3rd December 2014, twenty-five days after the prefeed. 6g RS5 cereal pellets with a toxic loading of 1.5 g/kg 1080, lured with 0.3% cinnamon and dyed green were used at an average rate of 1.18 kg/ha.

For the toxic operation, the aerially-treated area was split into two blocks; one (842ha) which was treated with helicopters flying at 170m swath widths, and the other (8,082ha) at 150m swath widths (see figure 2). The narrower swath widths led to toxic bait being sown at an average of 1.18 kg/ha instead of the 1 kg/ha as per best practice for aerial 1080 operations in kea habitat. This was approved by the Operations Director for the Northern South Island, and was a preliminary attempt at gaining information on whether swath width and the resulting bait distribution/density on the ground was having a significant influence on the results in terms of suppressing rodent numbers. More trials are likely to be carried out to investigate this in depth in future BFOB operations.

Handlaid – Toxic

111 hectares of the treatment area had toxic baits applied by hand (the non-toxic prefeed was applied aerially to this area), as it was close to sensitive boundaries with popular walking tracks: the Lake Edge, Loop and Honeydew tracks (see figure 2).

Handlaying was done by three DOC staff with Controlled Substances Licences, by following pre-marked lines at 100m spacings and broadcasting pellets by hand as evenly as possible. Pre-weighed quantities of bait were arranged for sub-sections of the area to assist the staff in assessing the amount of bait to spread in a given area.

The handlaying part of the operation was carried out on 5th December 2014, twenty-seven days after the prefeed. 6g RS5 cereal pellets with a toxic loading of 1.5 g/kg 1080, lured with 0.3% cinnamon and dyed green were used at a rate of 1 kg/ha.

Methods: monitoring

Result monitoring: Tracking tunnels

Tracking tunnels (TTs) have long been used in the RNRP as an index of rodent activity to allow comparisons between treatments. The existing RNRP rodent tracking tunnel network continued to be used through 2014/15, however due to the interest of the public in aerial 1080 pest control, and due to the larger area being treated, this network was expanded on with additional tunnels being monitored in Big Bush and up the Travers Valley (see figure 4).

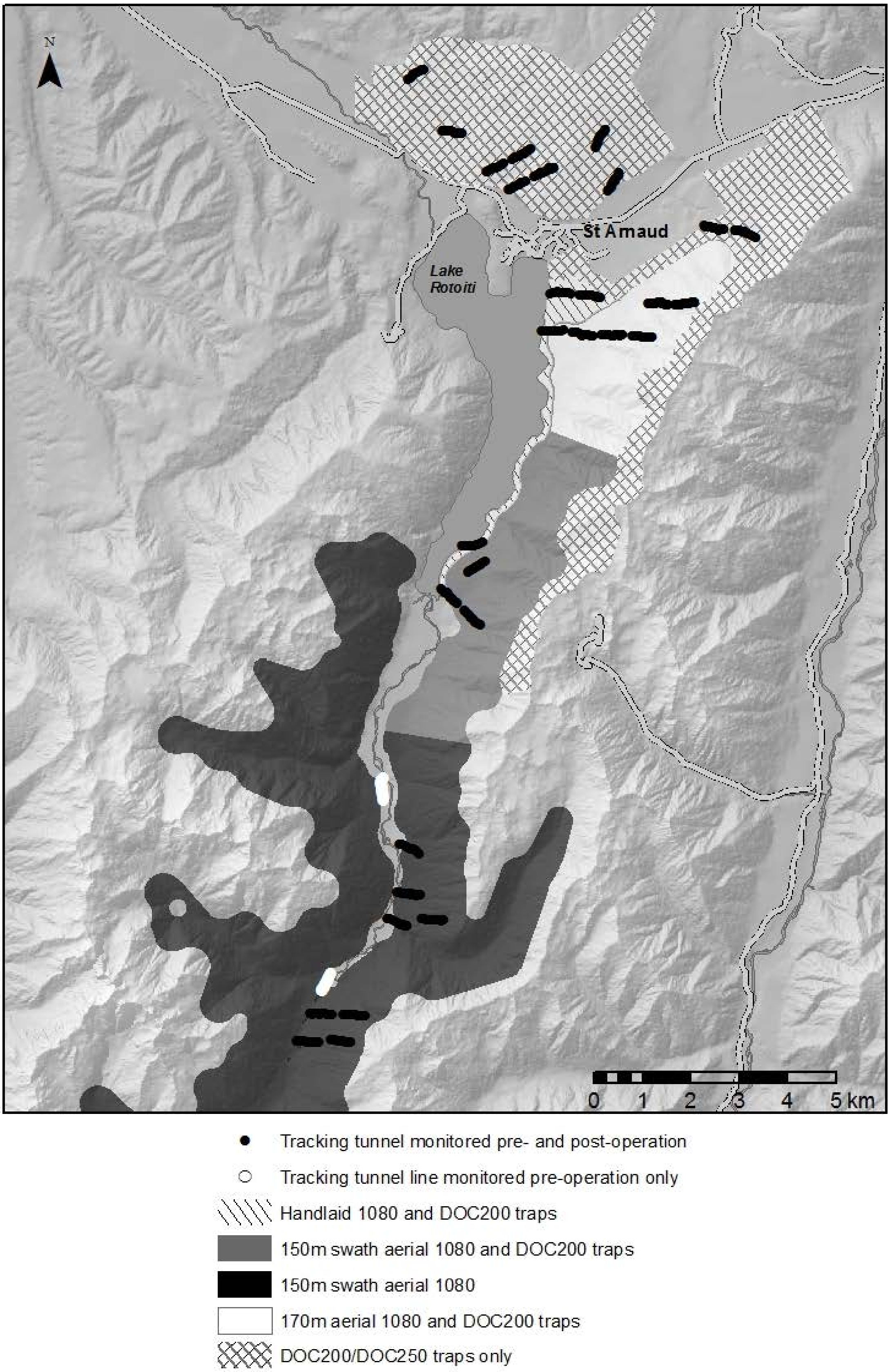


Figure 4. Location of Rotoiti Battle For Our Birds 2014 treatment site rodent tracking tunnel lines against treatment blocks.

Black Trakka™ cards were used set in 60-cm black coreflute tunnels, with peanut butter applied to both ends of the wooden base as a lure, and cards left out overnight as per the method in Gillies & Williams (2013).

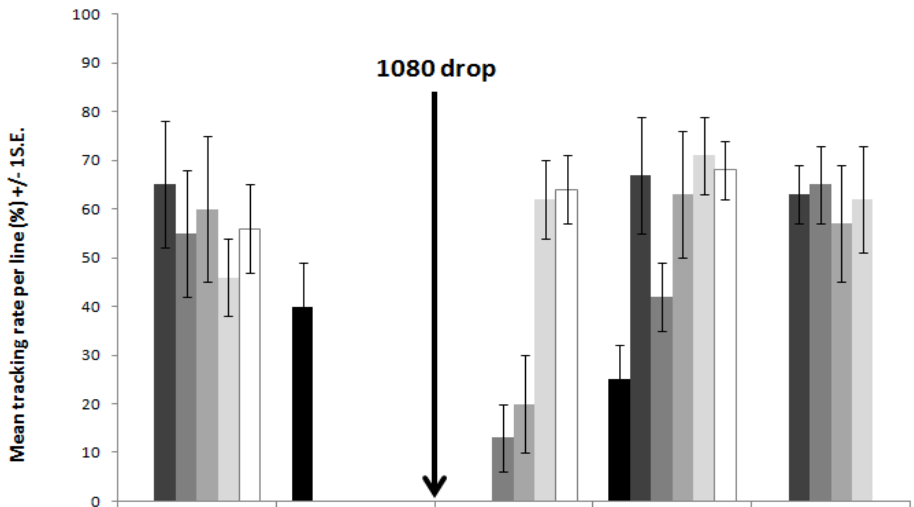
Rodent TT monitoring is usually carried out four times a year (August, November, February and May). In 2014, with the installation of new TT lines and the pressure on staff created by the extra workload involved in organising an aerial 1080 operation, this schedule was not able to be followed. The Travers lines were not included in the August monitoring round as they were not installed until September. These Travers TTs were monitored in October, however no rodent TT monitoring took place at all in November. All TT lines, including Rotoroa non-treatment lines, were monitored in December shortly after the aerial operation, as well as between late January and early March in 2015. In May 2015 both the Travers lines and the Rotoroa lines were not able to be monitored due to lack of staff resources and poor weather.

Outcome monitoring: SI robin nesting success

See *section 2.1.2.6 BFOB SI robin monitoring* for details on this project.

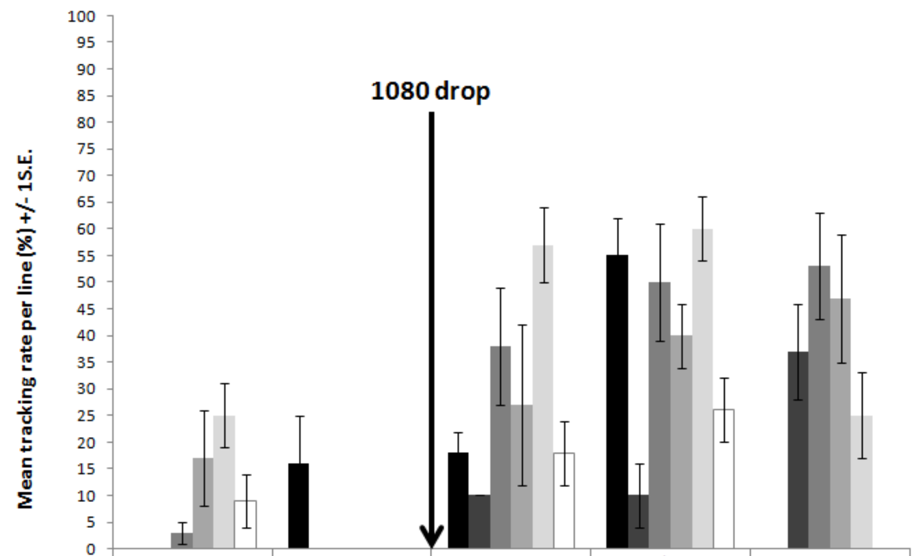
Results

The result target for this operation was standard: to reduce rat tracking within the treated area to a tracking index lower than 5%. There was no target for mouse tracking since mice were not specifically targeted by the operation, but mouse tracking results were also recorded, as mouse population dynamics may well be an important factor in the efficacy of aerial 1080 operations in beech forest during mast years.



	Aug-14	Oct-14	Dec-14	Feb-15	May-15
150m swath 1080 only	no data	40	0	25	no data
150m swath 1080 and traps	65	no data	0	67	63
170m swath 1080 and traps	55	no data	13	42	65
handlaid 1080 and traps	60	no data	20	63	57
traps only	46	no data	62	71	62
non-treatment	56	no data	64	68	no data

Figure 5. Rat tracking results in different 1080 and stoat trap treatment blocks at Rotoiti and Rotoroa, 2014/15. See "discussion" text for important points to consider when interpreting these results.



	Aug-14	Oct-14	Dec-14	Feb-15	May-15
150m swath 1080 only	no data	16	18	55	no data
150m swath 1080 and traps	0	no data	10	10	37
170m swath 1080 and traps	3	no data	38	50	53
handlaid 1080 and traps	17	no data	27	40	47
traps only	25	no data	57	60	25
non-treatment	9	no data	18	26	no data

Figure 6. Mouse tracking results in different 1080 and stoat trap treatment blocks at Rotoiti and Rotoroa, 2014/15. See "discussion" text for important points to consider when interpreting these results.

During track clearance, tracking tunnel monitoring and other post-operation fieldwork no non-target carcasses were found. One monitored kea was found dead after the operation, the body was sent for necropsy and the diagnosis was death from 1080 poisoning (see *section 2.1.2.7 BFOB kea diversion project* for more details).

Discussion

The intention at Rotoiti was originally to be able to compare tracking rate results between four treatments: treated with aerial 1080 only, treated with aerial 1080 and stoat trapping, treated with stoat trapping only, and not treated. However, many factors cause interpretation of the RNRP rodent tracking tunnel data collected in 2014/15 to be difficult:

- The new Travers TT lines were installed prior to the aerial treatment area boundary being finalised. This led to two of the lines (those coloured white in figure 4) being within the excluded Travers flats, and several of the other lines crossing or being close to the edge of the treated area.

- The Travers TT lines were only installed in September 2014. Not only does this mean that there is no historic data available for comparisons, but the known neophobia of rats could potentially have led to lower tracking rates on those lines compared to the pre-existing lines elsewhere.

- As described in the *Methods* section, not all sets of TT lines were measured during each measuring period, and monitoring was not always done during the standard month due to limitations on staff resources available.

- Because the existing RNRP TT lines were planned and installed years ago to monitor ground-based rat and stoat control over a much smaller area, the lines were not ideally located to provide data to assess the much larger aerial treatment area. Instead lines are either biased towards the end of the treatment area which received the highest reinvasion pressure, or are very close to the untreated Travers flats which would also have been a source of reinvasion.
- The obligation to handlay 1080 over part of the treatment area, as well as the last-minute (four days prior to operation) division of

the aerial treatment area into two blocks using different swath widths, led to a much greater number of treatment types being present within the area than originally intended. The pre-existing TT lines did not fit well within the boundaries of these (see figure 4), and too few tunnels were within each treatment type to allow a robust comparison to be made:

- Non-treatment (Rotoroa): 12 rodent TT lines
- Stoat trapping only, no 1080 (Big Bush and north of BFOB treatment area on St Arnaud Range): 10 rodent TT lines
- 170m-swath aerial 1080 and stoat trapping (northern St Arnaud Range): 6 rodent TT lines (1 partially in handlaid area)
- Handlaid 1080 and stoat trapping (Loop track area and long thin stretch along Lake Edge track): 3 rodent TT lines (1 partially in 150m aerial 1080 area)
- 150m-swath aerial 1080 and stoat trapping (St Arnaud Range alongside Lake Rotoiti): 3 rodent TT lines (1 partially in handlaid 1080 area)
- 150m-swath aerial 1080 only (remainder of Travers catchment): 8 rodent TT lines (3 in Travers flats, partially outside treatment area)

It is very important to bear these points in mind when trying to interpret the results shown in figures 5 and 6.

The initial post-operation TT results seen in figure 5 indicate differences in rat control results between treatment types, and could be taken to suggest that the swath width did influence operation success, that handlaying bait was not as successful as aerially sowing bait, and that all 1080-treated areas had much lower rat activity immediately after the BFOB operation than areas where stoat trapping alone was carried out, or where no pest control was undertaken at all.

However, because of the points identified that complicate the data interpretation, such inferences are unreliable. The most certain conclusions that can be drawn from rodent TT results in 2014/15 are:

- More thorough trials need to be carried out to investigate the influence of swath width and other bait distribution factors on the success of aerial 1080 operations, since these results suggest that swath width may be having some effect.

- The location of RNRP TT lines needs to be carefully reviewed once a decision has been made about whether RNRP rat control in the future is likely to be primarily aerial or ground-based.

- While rat tracking indices dropped significantly immediately following the aerial 1080 operation, they recovered relatively quickly to higher levels than is desirable.

- Mouse tracking results were more variable than those for rat tracking, and mouse tracking rates did not sharply drop immediately after the BFOB operation in 1080 treatment areas unlike rat tracking rates.

There are many possible explanations for the relatively quick recovery of the rat population in the treated area, including: the late date of the operation when the rat population had already grown exponentially, the many exclusion areas providing pockets of survivors to fuel reinvasion from within the treatment area, the relatively small and thin treatment area being vulnerable to reinvasion from the outside, and the sowing rate being too low given the extremely high rat abundance – these and other factors are being investigated in depth by DOC scientists, and future BFOB operation protocols will take into account learnings from BFOB 2014.

Note that for the BFOB programme there has been national-level TT data analysis and interpretation, which has used the RNRP raw data alongside that from other BFOB sites, but has carried out independent analyses using models to project rat tracking rates over time. Results seen in public news broadcasts will be based on these national-level analyses, and may therefore differ slightly from the results shown in this report due to different analysis methods being used.

Aside from the TT monitoring results, the DOC Nelson Lakes biodiversity team learnt a lot during the course of preparing for and carrying out the BFOB operation. For more detail about operational learnings, refer to Pestlink report 1415STA02 and BFOB documents listed in Appendix 2. Some key opportunities for improvement that came out of the operation are:

- Handlaying 1080 took a lot of resources in planning, certification requirements and carrying out the fieldwork, for poor result likely due to poor bait coverage. In future operations it should be proposed to the Public Health Officer that the area is treated aerially with a higher level of track closure and clearing, else not treated at all.

- A future aerial pest control operation at Rotoiti should ideally take place much earlier in the year (ideally July-August) in order to control rats before they reach plague proportions and to provide protection to birds during the breeding season.

- When many aerial 1080 operations are being carried out over the same period of time, issues such as receiving Council and Public Health consents in time, and operations using the same helicopter operators competing for weather windows, become a bigger concern. This was the first time DOC had attempted such a large pest control operation, so the necessary infrastructure, skills and teams within the department had to be built from scratch. Work has already begun on preparing a more nationally co-ordinated approach for future BFOB programmes.

Now that aerial pest control has been applied once in the RNRP, RNRP managers and the RNRP technical advisory group need to consider whether the RNRP is to move from the ground-based control trials it has generally done in the past towards being regularly involved in trials of aerial pest control methods, which are likely to be increasingly used in South Island beech forest conservation. There is a risk if the RNRP does not take this opportunity and continues to focus on trials on ground-based pest control (rat control in particular), that it might lose some relevance as a conservation research site if it is only trialling tools that are less likely to be widely used in this ecosystem type.

Discussions with DOC scientists have highlighted several reasons why Nelson Lakes National Park provides an excellent site for landscape-scale trials, including the five roughly parallel north-south oriented valleys with similar forest types present, the accessibility of these valleys by boat or vehicle, the presence of alpine habitat, and the long history of data collection in this area.
However, carrying out such trials rigorously would require substantial resourcing, which may not be available or may need to be re-directed from other projects. Careful thought therefore needs to be put into the RNRP's place in future conservation research.

2.1.2.4 BFOB mustelid control and monitoring

Introduction

The BFOB operation was primarily targeting rats, however as rodent population dynamics are known to influence mustelid (primarily stoat *Mustela erminea* and weasel *M. nivalis*) population dynamics in New Zealand forests (Blackwell et al. 2001), rodent and mustelid control are often closely inter-related.

While mustelids cannot be poisoned directly by 1080 baits, they can be killed by secondary poisoning through eating rodents that have themselves eaten the poison (Fairweather et al. 2015). The Rotoiti BFOB operation was considered to therefore provide landscape-scale stoat control over the treated area, by directly poisoning rats.

The situation for the smaller weasel is less clear. Aerial 1080 is not currently approved for use specifically to control mice, which are the main prey of the smaller weasel rather than the larger rats (King, 2005). There are several questions around the efficacy of aerial 1080 for mouse control, and the influence of aerial 1080 on stoat-rat and weasel-mouse predator-prey dynamics and the interaction of these, that remain to be answered. The Rotoiti BFOB operation in 2014 was not planned to address any of these questions, but this is a possibility worth exploring in the future.

Methods: control

See *Methods: control* part of section *2.1.2.3 BFOB rodent control and monitoring* for details of the 1080 operation, and see *section 2.1.3.1 RNRP mustelid control* for details of the RNRP stoat trap network.

Methods: monitoring

Result monitoring: Tracking tunnels

As for rodents, tracking tunnels (TTs) have long been used in the RNRP as an index of mustelid activity to allow comparisons between treatments. Unlike rodents, the different mustelid species cannot be reliably distinguished by their footprints, therefore the mustelid TT index is just that – for all mustelids combined.

The existing RNRP mustelid tracking tunnel network continued to be used through 2014/15, however due to the interest of the public in aerial 1080 pest control, and due to the larger area being treated, this network was expanded on with additional tunnels being monitored up the Travers Valley (see figure 7).

For the first time, this year extended mustelid TT surveys were carried out in addition to the standard three-night surveys. The standard surveys are not considered particularly effective for monitoring mustelids when they are at low density (C. Gillies (DOC), *pers. comm.*), therefore a protocol for extended two-three week surveys was developed by Josh Kemp (DOC scientist) for testing to see if this method would yield more informative results.

For both survey types Black Trakka™ cards were used set in 60-cm black coreflute tunnels. For standard three-night surveys a piece of fresh rabbit was placed as a lure on the mid-point of the inked card, and cards left out for three nights as per the method in Gillies & Williams (2013). For extended surveys a piece of salted rabbit in a sealed metal mesh parcel was attached at the mid-point of the inked card using a zip-tie, and cards were left out for two-three weeks as per the method in *Instructions for Extended Stoat Survey* (DOC-1531902).

The intention was to carry out both three-night and extended surveys at each monitoring instance. Mustelid TT monitoring is usually carried out twice a year (November and February), although was done more frequently in the RNRP during the self-resetting trap trial over 2012-2014.

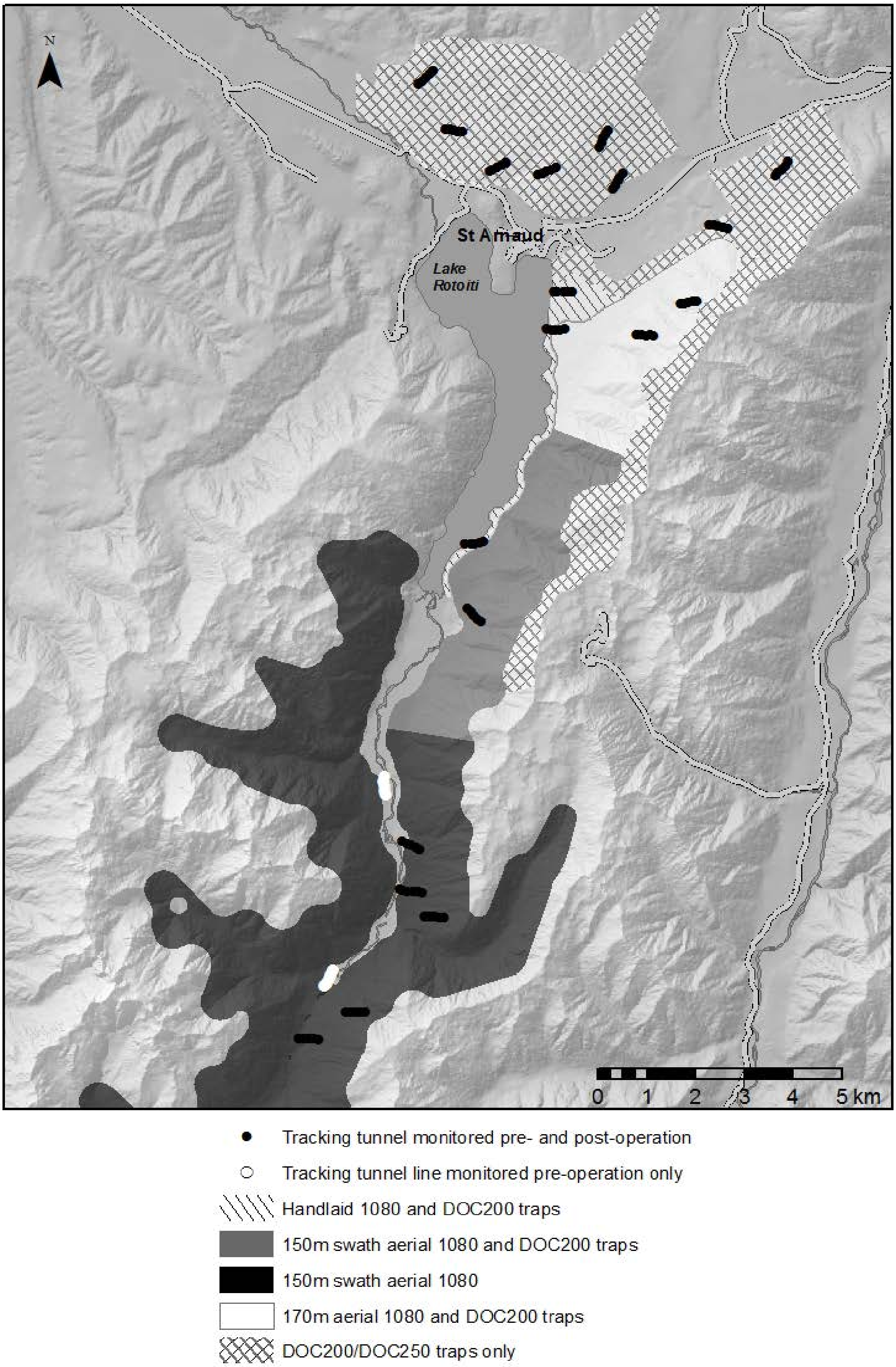


Figure 7. Location of Rotoiti Battle For Our Birds 2014 treatment site mustelid tracking tunnel lines against treatment blocks.

In 2014, with the installation of new TT lines and the pressure on staff created by the extra workload involved in organising an aerial 1080 operation, this schedule was not able to be followed as thoroughly as would have been ideal. Three-night surveys on the Rotoiti and Travers but not Rotoroa TT lines were undertaken in October in order to provide pre-control data. No mustelid TT monitoring took place in November. In January 2015 the Rotoiti lines received three-night and extended surveys, and in February the Travers lines also received both survey types, however only five Travers lines were surveyed in February compared to seven in October since two of the lines ended up outside the 1080 treatment area once exclusions had been imposed. In March a standard three-night survey was done on the Rotoroa lines.

Since the BFOB operation was explicitly targeting rats, not mustelids, when resources were limited rodent TT monitoring was prioritised over mustelid TT monitoring, which unfortunately led to mustelid monitoring in 2014/15 not being carried out to the usual standard.

Outcome monitoring: SI kākā and great spotted kiwi monitoring
See *sections 2.1.2 Kākā monitoring* and *2.2.3 Great spotted kiwi population monitoring* for more details on these projects.

Results

There was no set target for mustelid tracking for the BFOB operation, since the operation was specifically targeting rats. However, the aim of all mustelid control in the RNRP is to suppress mustelids to a tracking rate below 5%, the target that is considered to enable kākā and other native birds to breed successfully (Greene et al. 2004; Taylor et al. 2009).

As for rodents, the intention for mustelid monitoring at Rotoiti was originally to be able to compare tracking rate results between these blocks: treated with 1080 only, treated with 1080 and stoat trapping, treated with stoat trapping only, and not treated. However, as for the rodent data, many factors cause interpretation of the RNRP mustelid tracking tunnel data collected in 2014/15 to be difficult:

- The new Travers TT lines were installed prior to the aerial treatment area boundary being finalised. This led to two of the lines (those coloured white in figure 7) being within the excluded Travers flats, and several of the other lines crossing or being close to the edge of the treated area.

- The Travers TT lines were only installed in September 2014. This means that there is no historic data available for comparisons. While stoats are not thought to be as neophobic as rats, wariness of unfamiliar objects could still potentially have led to lower tracking rates on those lines compared to the pre-existing lines elsewhere, although this is not certain.

- As described in the *Methods* section, rodent TT monitoring was prioritised over mustelid TT monitoring when resources were scarce, therefore there is little or no data available from months when mustelid monitoring would usually be carried out (November and February).

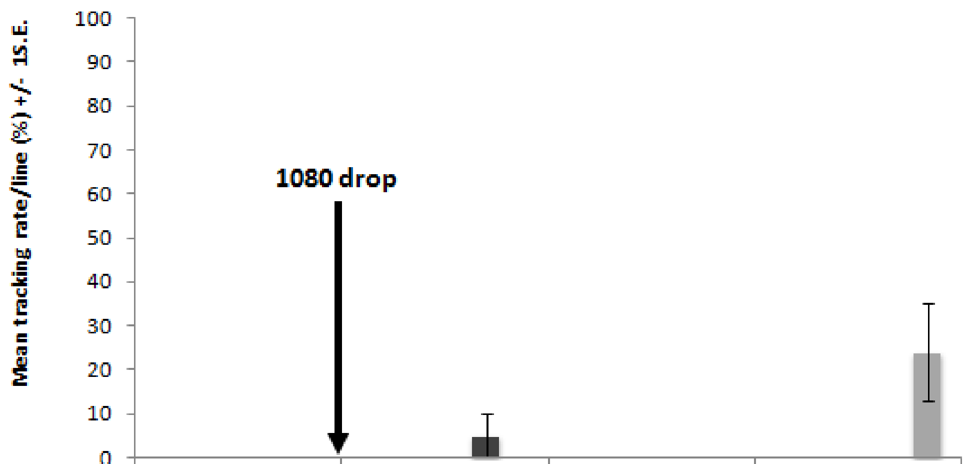
- Because the existing RNRP TT lines were planned and installed years ago to monitor ground-based rat and stoat control over a much smaller area, the lines were not ideally located to provide data to assess the much larger aerial treatment area. Instead lines are either biased towards the end of the treatment area which received the highest reinvasion pressure, or are very close to the untreated Travers flats which would also have been a source of reinvasion.

- The obligation to handlay 1080 over part of the treatment area, as well as the last-minute (four days prior to operation) division of the aerial treatment area into two blocks using different swath widths, led to a much greater number of treatment types being present within the area than originally intended. The pre-existing TT lines did not fit well within the boundaries of these (see figure 7), and too few tunnels were within each treatment type to allow a robust comparison to be made:
    - Non-treatment (Rotoroa): 9 mustelid TT lines
    - Stoat trapping only, no 1080 (Big Bush and north of BFOB treatment area on St Arnaud Range): 8 mustelid TT lines
    - 170m-swath aerial 1080 and stoat trapping (northern St Arnaud Range): 3 mustelid TT lines (1 of these partially in handlaid area)

- o Handlaid 1080 and stoat trapping (Loop track area and long thin stretch along Lake Edge track): 2 mustelid TT lines
- o 150m-swath aerial 1080 and stoat trapping (St Arnaud Range alongside Lake Rotoiti): 1 mustelid TT line
- o 150m-swath aerial 1080 only (remainder of Travers catchment): 7 mustelid TT lines in October period (2 in Travers flats, fully outside treatment area, 2 more partially outside treatment area), 5 in February period (2 partially outside treatment area)

It is very important to bear these points in mind when trying to interpret the results shown in figure 8.

More detail on the RNRP stoat trap catches is in *section 2.1.3.1 RNRP mustelid control*.



	Oct-14	Jan-15	Feb-15	Mar-15
150m swath 1080 only	0	no data	0	no data
150m swath 1080 and traps	0	0	no data	no data
170m swath 1080 and traps	0	0	no data	no data
Handlaid 1080 and traps	0	0	no data	no data
Traps only	0	5	no data	no data
Non-treatment	no data	no data	no data	24

Figure 8. Mustelid three-night survey tracking results in different 1080 and stoat trap treatment blocks at Rotoiti (all treatments) and Rotoroa (non-treatment), 2014/15. See text for important points to consider when interpreting these results.

Since an extended survey was only carried out once, and only at Rotoiti not Rotoroa, there is little data to report on. The January/February extended surveys resulted in 10% (+/-10) mustelid tracking in the

"Handlaid 1080 and traps" treatment area, and 0% tracking in all other areas.

Discussion

Due to the paucity of mustelid monitoring data from 2014/15 it is practically impossible to draw any confident conclusions about the impact of the BFOB operation on the local mustelid population.

Anecdotally there appeared to be a boom in weasel numbers both here at Rotoiti and at other sites in the northern South Island this year. Finding out whether this observation is true by comparing trap catches this year to those from previous years is complicated by unreliable differentiation between stoats and weasels in historic data. Tracking tunnels are also unable to provide this information as it is very difficult to correctly distinguish between stoats and weasels by their footprints (C. Gillies, *pers. comm.*)

Questions have been raised around whether effective rat and stoat control might lead to a mouse-weasel predator-prey system filling that void if mice are not also controlled during mast years; more thorough research is needed to determine if this is the case and if so, how effective mouse control can be achieved.

2.1.2.5 BFOB possum control and monitoring

Introduction

Brushtail possums (*Trichosurus vulpecula*) were a second official target species for the 2014 Rotoiti BFOB operation. Possums are a threat to native plant species such as threatened mistletoe present in the RNRP, as well as to native birds and other fauna such as the *Powelliphanta* snails which they are known to prey on (Walker, 2003).

Possum control through kill-trapping has been carried out in the RNRP for many years (see *section 2.1.5.1 RNRP possum control and monitoring* for more detail), but reinvasion from the Travers Valley, where there has been no regular possum control, has been a constant pressure. Aerial 1080 operations for possum control have been carried out successfully for many years by DOC as well as other organisations such as TBfree NZ, with possums being killed by 1080 via direct poisoning.

The target for BFOB possum control was to reduce the Possum Activity Index (PAI), calculated from waxtag bite marks, to less than 15%.

Methods: control

In the BFOB operation 6g toxic baits were used instead of 12g baits, despite the latter being the best practice standard for possum control operations since a single 12g bait contains a lethal amount of 1080 for a large possum. This was because the beech mast-fuelled rat irruption was the primary reason behind carrying out the aerial 1080 operation, and 6g baits are the best practice standard for rat control.

It is possible to control possums using 6g baits as they move around enough to encounter more than one bait, however it is not recommended at high possum densities. Pre-operation possum densities in the RNRP were only moderate, based on waxtag monitoring results. For full detail of the BFOB operation see the *Methods* part of *section 2.1.2.3 BFOB rodent control and monitoring*.

Methods: monitoring

Result monitoring: waxtags

Waxtag monitoring was carried out as per National Pest Control Agencies (NPCA) guidelines for three-night waxtag surveys, available from the website: www.npca.org.nz/index.php/a-series-best-practice.

Lines of twenty waxtags were set up along eight of the tracking tunnel monitoring lines in the Travers Valley (see figure 9) in order to maximise the monitoring that could be done with a given number of person/days since resources were stretched. The waxtag lines were therefore not set up as randomly or over as large an area as would have been ideal, however given the limited fieldworker resources available this was the only option and was considered better than not carrying out any possum monitoring at all.

As per the rodent tracking tunnels, the waxtag monitoring lines were installed prior to the aerial treatment area boundary being finalised. This led to three of the eight lines ultimately being partially outside the treated area.

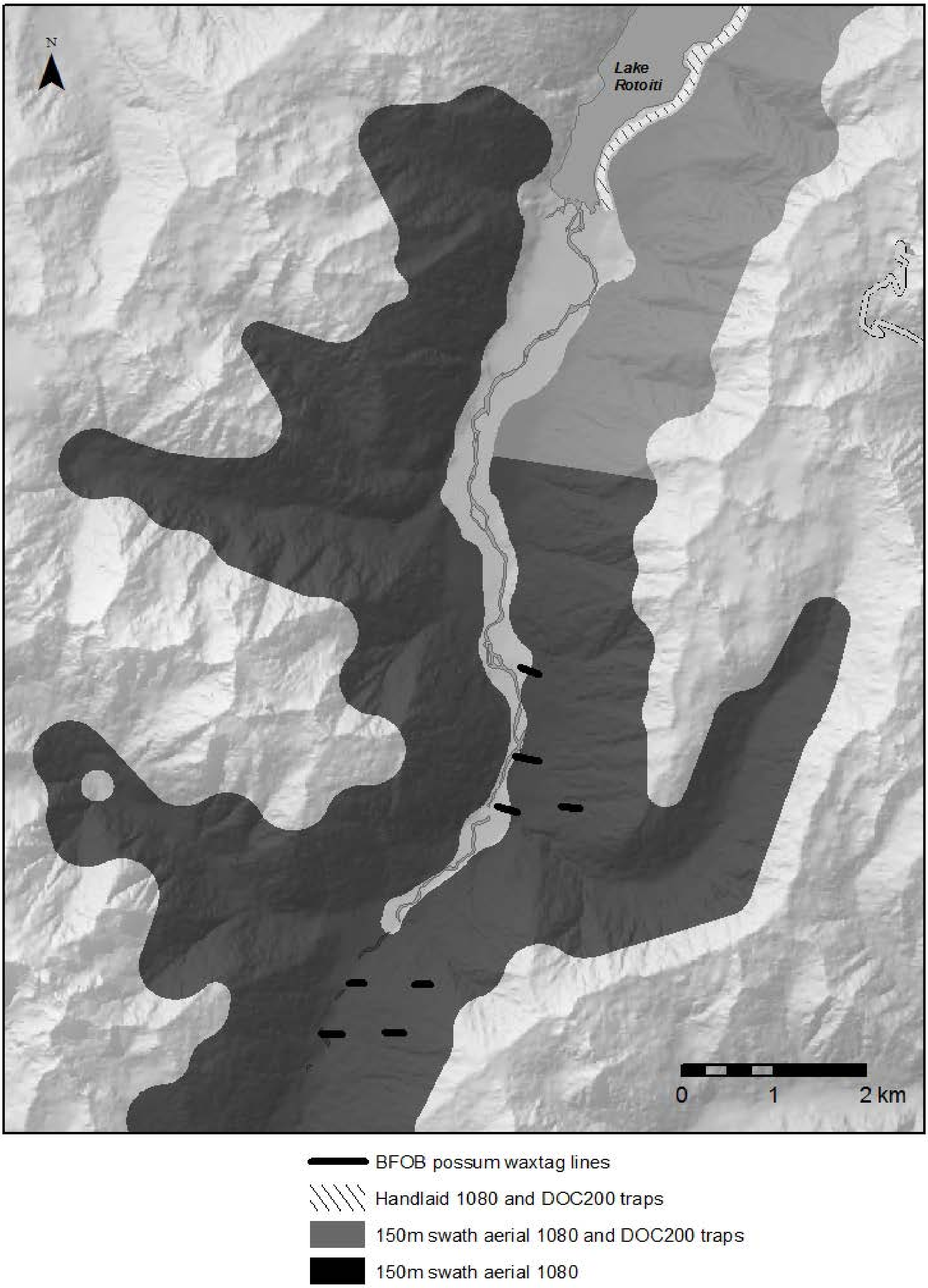


Figure 9. Location of possum monitoring wax-tag lines against treatment blocks for the Rotoiti Battle For Our Birds operation 2014.

Monitoring was done over the 14^{th}-17^{th} October 2014 (pre-operation), and the 17^{th}-20^{th} February 2015 (post-operation). A Possum Activity Index (PAI) was calculated using the template provided by the NPCA.

Outcome monitoring: mistletoe health

The palatable mistletoe species are used for possum control outcome monitoring, for more detail see *section 2.1.11 Mistletoe monitoring*.

Results

If all Travers Valley waxtag monitoring lines are included (i.e. including lines that were in the Travers flats outside the treated area) the results show a reduction from a PAI of 19% +/- 12 (2 S.E.) in October 2014 to 4% +/- 9 in February 2015.

If the two lines with approximately half of the waxtags in the Travers flats (outside the treatment area) are excluded from the calculation, then the results show a reduction from a PAI of 10% +/- 6 to 0%.

The two lines that were approximately half outside the treatment area (2A and 3B, see figure 9) had the highest number of waxtags with bite marks pre-operation; 50% and 40% of tags respectively, whereas the other six lines ranged between 0% and 20% of tags with bite marks.

The only line of the eight that had any possum bite marks in the post-operation measurement was line 3B, the northernmost line that was approximately half outside the treatment area (see figure 9). By comparison, in the pre-operation measurement all but one of the eight lines had possum bite marks present.

See *section 2.1.5.1 RNRP possum control and monitoring* for results from regular RNRP possum trapping, which includes trap lines within the BFOB treatment area.

Discussion

The results indicate that the highest possum activity both before and after the aerial 1080 operation was on lines close to or within the untreated Travers Valley flats exclusion zone. If the Travers flats had not been excluded, it is possible that a PAI of 0% across all lines would have been achieved. However, the 4% that was achieved was well under the target of <15%, so the operation was still successful in meeting its objective with regards to possum control.

The possum activity close to the exclusion zone demonstrates the impact of leaving untreated areas within a treatment block: pockets of pest animals survive the operation, meaning that not only does the protected area face reinvasion from its perimeter, but also from the inside. Any future operations should aim to minimise or eliminate any such untreated areas in order to maximise the benefit to native species from the operation by removing predators for as long as possible.

2.1.2.6 BFOB SI robin monitoring

Introduction

The South Island robin (*Petroica australis australis*) is an endemic passerine which, although classified as not threatened (Robertson et al. 2013), has declined dramatically since European settlement, primarily due to habitat loss and mammalian predation (Bell 1986). Robins are territorial year-round and mainly breed in spring, although at Lake Rotoiti the robin breeding season ran from August to February in 1998/99 (Etheridge & Powlesland 2001) and 2010–2012 (G. Harper, DOC, *pers. obs.*).

Robins have been monitored within the Core Area of the RNRP since 1998/99 as a measure of the effectiveness of rat control operations. Until 2007 the study area was approximately 120 ha, however so few robins were being located in years prior to 2007 that the area was then expanded south of the Loop Track, increasing the study area to 162.1 ha.

In 2014 a heavy beech mast at Lake Rotoiti triggered the implementation of an aerial 1080 operation to prevent rodent and subsequent stoat population irruptions (see *section 2.1.2 Rotoiti Battle For Our Birds operation*). To measure the effectiveness of this rat control operation, robin breeding success was again used as an outcome monitoring measure. The annual robin monitoring programme was expanded to cover a larger area, thereby including more pairs and with the intention of allowing comparisons to be made between two different treatments; stoat control only through trapping, and rat/stoat control through both aerial 1080 and trapping.

Methods

Surveys in both proposed treatment areas took place from the end of July to mid-August 2014 to locate paired and unpaired robins within each area prior to the breeding season.

The western flank of the St Arnaud Range within the RNRP was the treatment area where both stoat trapping and aerial 1080 were to be applied. The robin study area from previous years was expanded to include the entire area east of Lake Rotoiti from Snail Ridge in the north to the Lakehead scree fan in the south, from the lake edge to approximately 900m asl, with all rat bait station lines surveyed.

The Big Bush scenic reserve was the treatment area where only stoat trapping was applied. In areas where the Big Bush wasp grid was present the wasp grid lines and a line approximately halfway between each of these grid lines were surveyed. In areas where the wasp grid was not present surveyors followed contours at roughly 100m intervals. See figure 10 for an overview of actual treatment areas, survey areas and monitored nests.

Each treatment area was surveyed twice, requiring eighteen person days in total. Surveyors walked slowly along each line whilst tapping a mealworm container; they stopped every 100m for one–two minutes and tapped loudly to attract robins.

If a robin was sighted, the container was tapped until the robin approached; the bird was then fed as a reward and the following information was recorded: the date, observer, band combination (or 'no bands' if none present), sex, whether paired or alone, location and behaviour (e.g. eating mealworms, caching mealworms, flying off with mealworms) since these behaviours indicate breeding status of the individual. If a robin was not sighted, the surveyor continued to walk and tap along the line.

If an un-banded robin was sighted during the survey, attempts were made to capture and band the robin shortly after. Known pairs were observed once a week to monitor for breeding behaviour that indicated nesting. Nests were located and monitored in order to determine fledging success either using trail cameras or by weekly visits. Unpaired males were also visited once a week to monitor for pairs forming and survival.

A “roll call” of all monitored birds was made prior to and after the aerial 1080 operation in order to collect data on adult survival.

Results

In the St Arnaud Range proposed “stoat trapping and aerial 1080” treatment area seven pairs and seven single males were found during the initial surveys. However these surveys were done prior to the 1080 treatment area being finalised, which ultimately led to survey effort being carried out in areas which were not eventually treated with aerial 1080 (see figure 10):

- Due to imposed non-treatment buffer zones altering the boundary of the aerial 1080 treatment area, three of these seven pairs ended up having territories within buffer zones where no 1080 would be applied, therefore only the data from four of these pairs was relevant for analysis.
- All eight of these four monitored pairs’ nesting attempts were in areas which ultimately received hand-laid, not aerially broadcast, 1080 due to the areas being alongside popular walking tracks.
- All of the eight monitored nests were within 250m of the hand-laid 1080 treatment boundary, which calls into question the validity of any results from these nests since reinvasion from adjacent untreated areas was likely to be considerable.

In the Big Bush “stoat trapping only” treatment area five pairs and twelve single males were found and monitored, with six nesting attempts observed.

Unfortunately the available staff resources did not allow for more surveying to increase the number of robin pairs being monitored. The initial target discussed in an RNRP Technical Advisory Group meeting in April 2014 was to monitor at least twenty pairs in each treatment area, preferably more, but the number of pairs monitored did not come even close to this, which means that the results are ultimately not particularly informative.

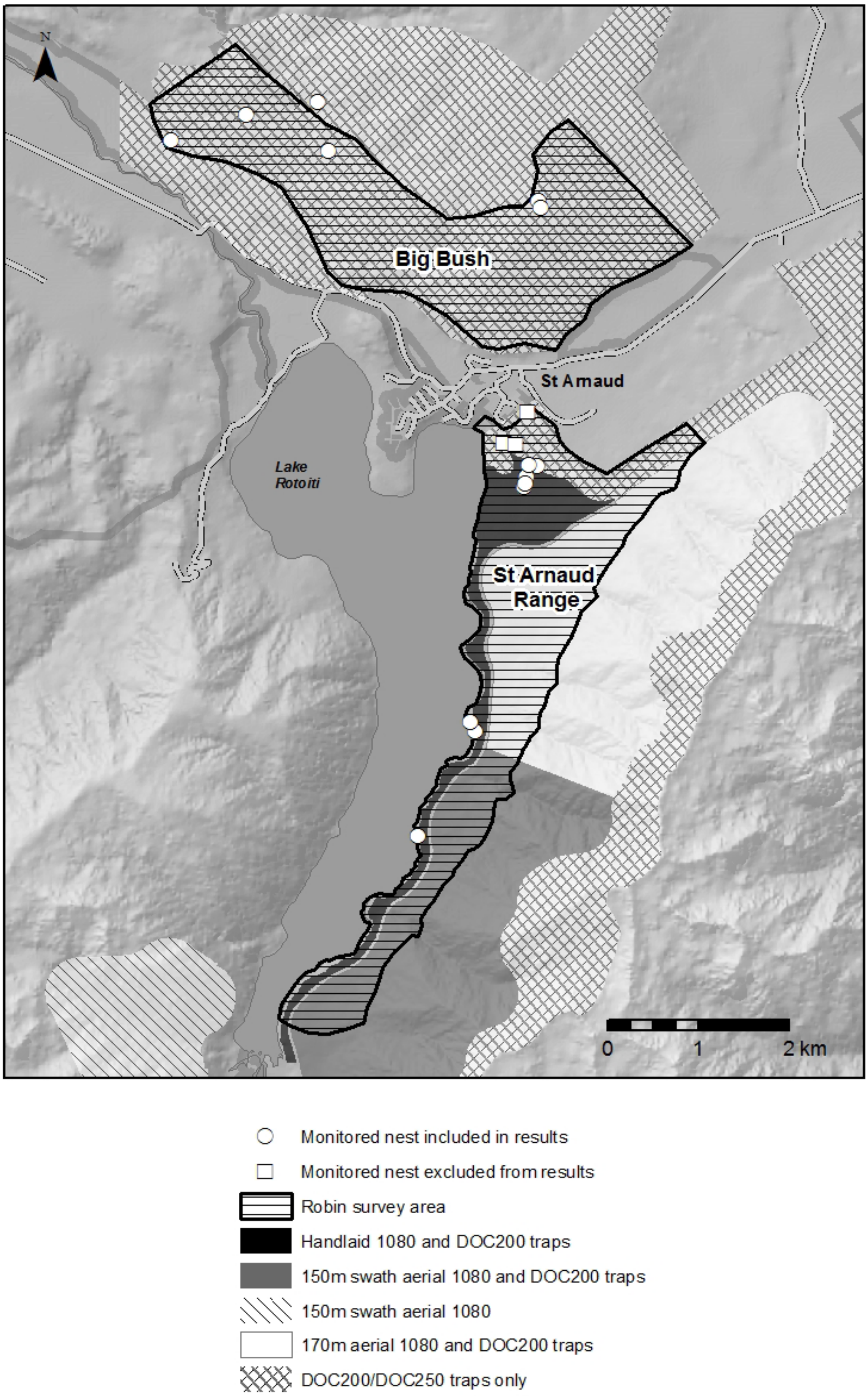


Figure 10. Overview of Rotoiti Battle For Our Birds treatment areas, area surveyed for South Island robins, and the location of monitored nests in RNRP 2014/15.

Of the total fourteen nesting attempts observed, eleven took place between September and the end of November, prior to the 1080 operation (six in St Arnaud Range, five in Big Bush). Only three attempts were observed late in the breeding season after the 1080 operation occurred in early December (two in St Arnaud Range, one in Big Bush).

Prior to the 1080 operation there was a difference observed between sites in nesting success with only 16.7% of monitored nests in St Arnaud Range succeeding (one out of six attempts) compared to 80% in Big Bush (four out of five attempts) (see table 2). Only one juvenile successfully fledged in St Arnaud Range, four in Big Bush. Of the failed nests in St Arnaud Range two failed at the chick stage and three at the egg stage. The nest that failed in Big Bush did so at the egg stage.

Table 2: Summary of 2014/15 RNRP South Island robin breeding monitoring effort and results prior to the BFOB 1080 operation being carried out.

Study area	St Arnaud Range	Big Bush
No. robin pairs monitored	4	5
No. nesting attempts	6	5
No. successful nesting attempts	1	4
No. nests failed at chick stage	2	0
No. nests failed at egg stage	3	1
No. attempts/pair	1.5	0.8
No. juveniles fledged	1	4
No. juveniles fledged/pair	0.25	0.8
No. females lost	0	0
% nesting success	**17**	**80**

After the 1080 operation had been carried out in early December, three nesting attempts were observed, two in St Arnaud Range and one in Big Bush (see table 3). All these nests failed, one at the chick stage and one at the egg stage in the St Arnaud Range, and the nest in Big Bush failing at an unknown stage.

Table 3: Summary of 2014/15 RNRP South Island robin breeding monitoring effort and results after the BFOB 1080 operation had been carried out.

Study area	St Arnaud Range	Big Bush
No. robin pairs monitored	4	5
No. nesting attempts	2	1
No. successful nesting attempts	0	0
No. nests failed at chick stage	1	?
No. nests failed at egg stage	1	?
No. attempts/pair	0.5	0.2
No. juveniles fledged	0	0
No. juveniles fledged/pair	0	0
No. females lost	0	0
% nesting success	**0**	**0**

The "roll calls" found five pairs and two single males both before and after the BFOB operation in Big Bush (five further single males ceased to be monitored before the operation due to staff time constraints). In St Arnaud Range five pairs and three single males were found both before and after the BFOB operation (one of these pairs has not been included in the final results as they were outside the eventual treatment area, and an additional two pairs and two single males ceased to be monitored before the operation took place, when it became clear that they would not be within the treatment area).

Discussion

For several reasons, the results from this year's robin monitoring programme were not as useful as an outcome measure of the rat control operation as was intended.

Firstly, low robin numbers in the survey areas and high workloads for staff limiting possible survey time could be spent led to fewer pairs being monitored than was considered necessary for informative results. Exacerbating this problem was the fact that the 1080 operation treatment area boundaries were not confirmed until well after robin monitoring had begun, leading to time being wasted monitoring pairs that were ultimately not able to be included in the results, as they fell outside the treatment area. It had been identified at an RNRP TAG meeting in April 2014 that it was essential that this study had high sample sizes, as so many previous studies that failed to provide conclusive results were due to sample sizes being overly small. It was suggested by TAG advisors that a minimum of twenty pairs in each treatment area would be necessary, with a higher number being better yet if possible. Ultimately only nine pairs were monitored in total, falling far short of the required sample size for informative results.

Secondly, all the pairs monitored in the "1080 and trapping" treatment area had territories located not only within the hand-broadcast area rather than the aerially-broadcast area, but they were very close to the edge of even the hand-laid area, with no monitored nest greater than 250m from an untreated area (see figure 10). This casts doubt on whether the results from these nests are valid to represent nests receiving protection from this treatment, given that reinvasion of rats into treated areas from untreated areas is a known issue.

Thirdly, the same factor of high staff workloads meant that not enough time was able to be spent monitoring pairs for breeding behaviour as was required. With at most once-weekly monitoring of pairs, it is likely that breeding attempts that failed very early were not observed at all, biasing the results.

Finally, most RNRP ground-based rat control operations have occurred in August-September to reduce rat numbers prior to spring when most native passerines are nesting, including robins. However in 2014/15 delays in decision-making (see *section 2.1.2 Rotoiti Battle For Our Birds operation*) meant that the Rotoiti 1080 operation did not occur until early December, with the aerial broadcasting occurring on 3rd December and the hand broadcasting on 5th and 8th December. Robin nesting at both monitored sites started in late September, and the majority of nests (eleven out of fourteen) occurred prior to this, thus receiving no protection from the 1080 operation. Since only three nests were monitored after the operation had taken place the sample size is too small to draw any conclusions on the effect of hand-broadcast 1080 on robin nesting success at this site.

For these reasons, an attempt at thorough analysis of the data collected will not be made in this report. The data is permanently stored if it is ever needed for future analysis (see Appendix 1 for a link to the database). Other studies have been done on South Island robin survival and nesting success through aerial 1080 operations with far higher numbers of pairs monitored, including a recent DOC Science & Policy four-year study over two such operations in the Marlborough Sounds that found a significant benefit to robins (J. Tinnemans (DOC), *pers. comm.*). This study was still collecting data in early 2016 and has not yet been published at the time of writing.

Predation of female robins on the nest is thought to be one of the principal impacts of high rat density, reducing the number of females available for breeding the following year. A male sex bias has consistently been reported in the RNRP core robin area, supporting this hypothesis. Although there were a high number of nest failures this year no females were lost this season. However, there was indeed a male sex bias recorded: seven single males were monitored in St Arnaud Range and twelve in Big Bush, compared to only seven pairs in St Arnaud (four of which were monitored) and five in Big Bush.

While this might be expected in Big Bush where the rodent population is not controlled, in the St Arnaud Range this is possibly a reflection of the failure of RNRP rat control operations to keep rat tracking at or under the desired 5% level during the robin breeding season in three consecutive years. However, it is also worth noting that all robin pairs found this year had some area of swamp within their territory. This has also been observed in previous years and could suggest that robins are habitat limited in the St Arnaud Range part of the RNRP, in which case robin density might not increase regardless of pest control success.

Trail cameras were used for the first time in the RNRP for monitoring robin nests, proving to be a useful tool with five nests monitored this way. This footage allowed the identification of nest predators at two nests and recorded the likely culprit of a third, this latter one having the camera set up the day after the nest had been predated. This highlights the importance of getting cameras onto nests quickly, particularly when rat abundance is high. Difficulties with camera placement led to cameras on two nests not recording properly, in the future cameras should be placed within one metre of the nest if possible.

Previous monitoring in the RNRP has shown that in general robin numbers tend to decline when rodent numbers are not controlled adequately. Numbers tend to increase when toxin operations have reduced rat tracking to low levels, with a lag of about one year. The BFOB operation occurred too late this year to provide much protection from predation for nesting robins. Any similar operations in the future should be planned to be carried out in July-August, before the breeding season.

If robin monitoring is used again as an outcome measure for future trials then the issues that caused poor data to be collected in 2014/15 need to be addressed. Adequate staff time needs to be allocated to the task, the treatment areas should be known more accurately in advance, surveying should be done in areas that are well within the treatment areas, robin pairs should be checked at least twice a week and trouble should be taken to ensure suitable camera placement.

2.1.2.7 BFOB kea diversion

Introduction

Kea are one of the species identified in the biodiversity restoration goals of the RNRP. When DOC Nelson Lakes staff began planning the BFOB operation in 2014, the risk to kea was a significant concern for several reasons: the Rotoiti kea population is small, kea are known to be vulnerable to 1080 in general due to their omnivorous diet and interest in novel objects, and the kea that frequent the Rainbow ski field are particularly vulnerable since they are "junk food" birds who are used to eating unnatural food items that are present at such sites (J. Kemp (DOC), *pers. comm.*).

The aerial treatment area was originally planned to cover alpine areas on the St Arnaud and Travers Ranges, as well as the majority of the Travers and East Sabine catchments. There were several known kea nest sites in the vicinity, which have been monitored over many years through the fitting of radio-transmitters to kea and mounting of trail cameras outside nests. Only one monitored nest site was actually within the proposed treatment area; on the western flank of the St Arnaud Range (see figure 29 in *section 2.1.9 Kea nest protection*).

DOC's code of practice for use of aerial 1080 in kea habitat (Crowell, 2014) was followed in the Rotoiti operation, and early in the planning process DOC staff also discussed options for minimising the risk to "junk food" ski field kea, in particular with Tamsin Orr-Walker of the Kea Conservation Trust (KCT). It was established that kea repellents under development were not yet at a stage where they could be relied on to prevent kea ingesting 1080 pellets. The outcome of these discussions was that DOC Nelson Lakes would test an idea that had been suggested to the KCT which was based on diverting the kea rather than repelling them, since to do nothing was not an acceptable option. This diversion idea is similar to the approach the KCT has taken in solving kea conflict problems over recent years, when kea have been moving into areas where people are not used to living alongside them and traditional responses such as the relocation of individuals have been neither sustainable nor effective.

Local DOC staff were conscious from the beginning that to do the proposed diversion project would require an enormous amount of effort, with daily visits to the diversion site necessary in order to make sure that food was not going to make the kea sick and to change toys to maintain the novelty aspect to keep the kea interested. DOC Nelson Lakes did not have the resources to maintain daily site visits, so having the reliable support of Friends of Rotoiti (FOR) volunteers would be essential for the project to be successful.

Local DOC staff were also very aware of the potential for perceived mixed messaging from DOC around the feeding of kea to result in a negative public response. The reason why this method was considered appropriate to trial at this site was because the kea at Rainbow ski field were considered to already be "junk food" birds as mentioned earlier, and therefore the diversion process would not be teaching them any behaviours that they were not already exhibiting.

When the Rotoiti BFOB operation was confirmed in order to protect native birds from heavy predation by rodents and mustelids, whose populations would reach plague proportions in the forest following the beech mast (as is known to happen from previous experience), DOC Nelson Lakes considered it a priority to attempt to provide some protection for the local kea population. It was clear from the start that this was to be a trial of an untested method to see whether it would have any positive influence on survival of "junk food" kea through an aerial 1080 operation, at a time when proven effective kea repellents remained unavailable.

Methods

Timing and location

Rotoiti was confirmed as a BFOB aerial 1080 site in late August 2014, but preparations began earlier when Rotoiti was shortlisted as a potential site if other planned operations were cancelled. The initial discussion on kea protection options with the KCT was held on 25th June 2014.

The intention was to set up the diversion area with at least a month of lead-in time before the 1080 operation, to allow kea to become habituated to going to it. The diversion area would first be set up as close to the ski field as necessary for the kea to locate it. Over time it would be gradually shifted down the road away from the ski field so that by the day of the aerial operation the diversion area would be well away from the loading zone.

However, it was difficult to judge the set-up timing accurately considering the date of the 1080 operation was unknown until shortly before the operation. This was due to both the influence of weather conditions and the fact that this operation was part of a national DOC programme so the timing was not completely under the local DOC office's control.

The project began on 15th September 2014 when two feed hoppers were set up (point 1, figure 11; E1588467, N5363405). On 17th September these hoppers were moved to a location where kea were encountered by a DOC staff member when servicing the hoppers (point 2, figure 11; E1589278, N5361987), thereby guaranteeing that some kea were aware of the existence of the hoppers. This meant that the slow process of moving the diversion area away from the ski-field was bypassed.

On 25th September a metal frame was set up (point 3, figure 11; E1589501, N5361598) and one of the hoppers was shifted to the same location. On 26th September the second hopper was shifted to the frame site, but shifted back to point 2 when no evidence of kea activity at the new site was seen. On 28th September the second hopper was relocated again to the frame site at point 3 because kea were present there. On 21st October the diversion area was shifted 200m further down the road (point 4, figure 11; E1589645, N5361460), where it remained for the rest of the project's duration.

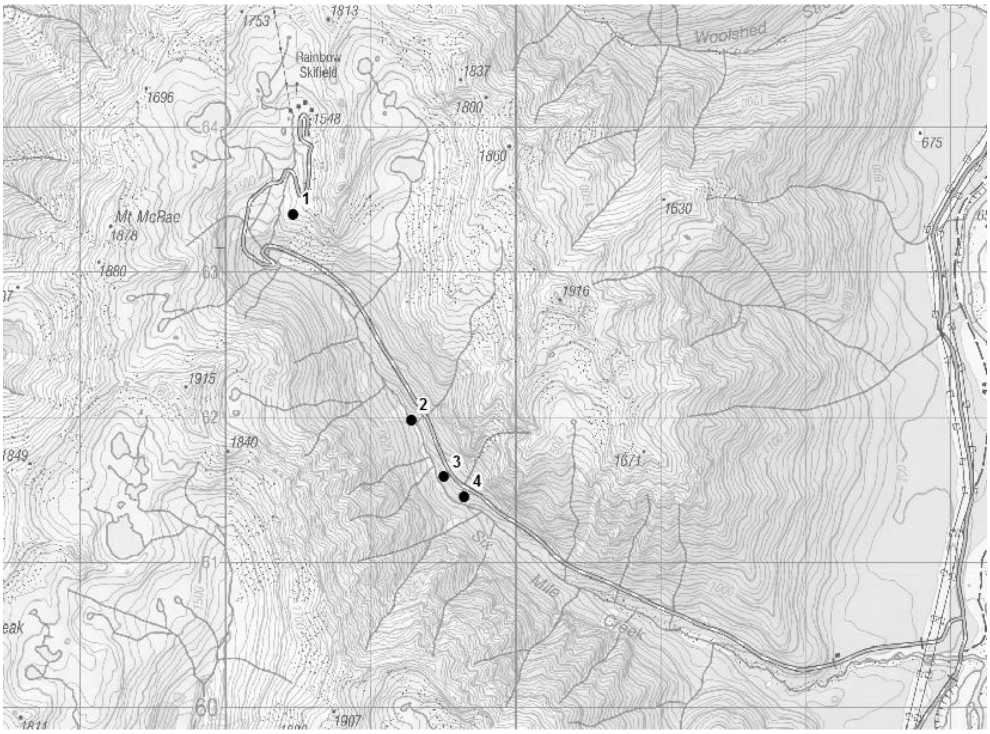


Figure 11. The four locations of the 2014 Rotoiti BFOB kea diversion area along the Rainbow ski field Road, Nelson Lakes National Park. Note points 2-4 are immediately beside the road, not some distance away as indicated by the Topo50 map background.

The prefeed aerial operation was carried out on 8th November, and the toxic operation on 3rd December. The diversion area was serviced daily, with food changed and hoppers cleaned, until 15th December at which point the frame and hoppers were removed. The area was re-visited several times after this date to monitor transmittered kea.

Kea diversion feeding

The diversion concept hinged on the theory that if kea were provided with a plentiful supply of preferred and high-energy food during and immediately after the operation, then they would be less inclined to consume 1080 pellets.

Foods such as mutton fat and cheese are known to be highly attractive to kea, however should not be fed in high amounts for prolonged periods of time as they could lead to health problems (Pullar, 1996; T. Orr-Walker (KCT), *pers. comm.*). Therefore the approach taken was to provide healthy food such as apples, carrots and oats based on kea captive rearing guides (Orr-Walker, 2010; Pullar, 1996) and advice from Corey Mosen of the KCT. A small amount of rich food such as cheese, sunflower seeds and peanuts was also provided over the entire period to ensure the kea remained interested. For a short period of time before, during and after the operation this rich and highly attractive food would be increased in quantity, to try to focus kea attention on the diversion area and reduce their desire to forage for food.

Two chicken feed hoppers with plywood sheets attached to the treadle to make a larger platform that was easier to open and safer for the kea (see figure 12) were loaned to DOC Nelson Lakes by Corey Mosen. The food put out was split between the two hoppers, and hoppers were cleaned out daily using hot water and detergent, with cold water to rinse. The food was initially chopped up into small chunks, but early on this was changed to grated to make it less similar in appearance to 1080 pellets.

Food type and weight put out was recorded daily, as well as the weight of food remaining from the previous day to calculate the amount of food taken (details recorded in the "results" tab of excel spreadsheet *Kea diversion plan through 1080 2014* (DOC-1470230)).

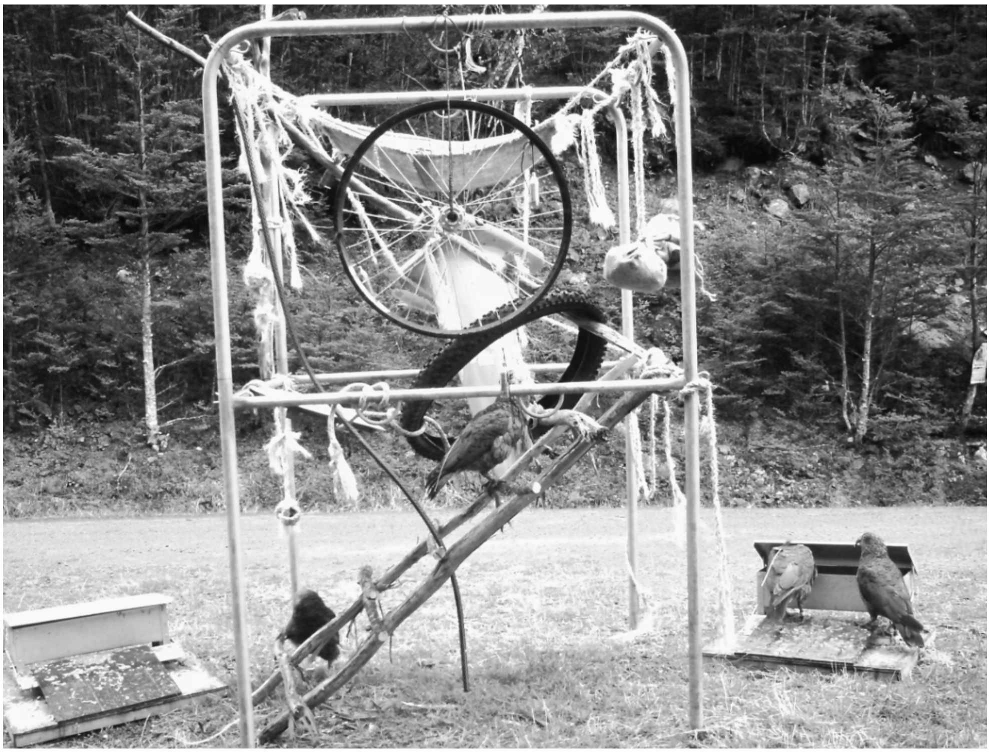


Figure 12. Four kea on the 2014 Rotoiti BFOB kea diversion frame and food hoppers on Rainbow ski field road, Nelson Lakes National Park.

Kea diversion playground

A metal frame (see figure 12) was loaned to DOC Nelson Lakes by the KCT. Once in place, items were added to the frame and changed regularly to provide stimulation for kea. Initially it was attempted to keep the items 'natural' e.g. pine cones inside hanging sacks, however over time a wider variety of items were used to maintain the novelty value of the diversion area, including a seesaw made from manuka branches and an old bicycle wheel that spun on its axle.

Kea diversion area servicing

In order to keep the diversion area effective and not put kea health at risk from old food going mouldy, the site was serviced daily. DOC staff attended the diversion area a minimum of twice a week, and FOR volunteers visited on all other days.

Staff/volunteers servicing the site followed a series of steps in order to create a consistent "cue" to kea that new food and entertainment was on offer at the diversion site. These were:

- Tying two large bright orange pack liners to the roof of the DOC truck used to access the site at the bottom of the ski field road before heading to the site. This was for two reasons:
    1. The bright colour moving up the road would hopefully catch the eye of any kea in the area.
    2. To attempt to differentiate the white DOC truck that brought food and toys to the diversion area from all the other white DOC trucks that would be moving up the road to the ski field on the days of the prefeed and toxic operations.
- Honking either an airhorn or the truck's horn on the way to the diversion area, again to attract the notice of any kea in the vicinity.
- Wearing high-viz vests while servicing the diversion area, again to attract the attention of nearby kea.

As well as tending to the food hoppers and frame toys, staff/volunteers would record any kea sightings including band information if possible, and use telemetry equipment to monitor for signals from any kea with transmitters that were in the vicinity. Once a trail camera was installed at the site, its SD card and batteries were also changed regularly.

Other data collected were: date, time, weather, names of people servicing the site and any other notes about equipment or signs that other species were visiting the diversion area, such as possums.

On the days of the prefeed and toxic operations, FOR members were stationed at the diversion area for the duration of the operation in order to provide as much stimulation as possible to any kea present, as well as to record what happened. On the day of the prefeed, two FOR members took on this task for the entire day. On the day of the toxic, this task was shared between three pairs of FOR members who worked in shifts.

Kea safety/public information

As the ski field was still operating when the diversion project was initiated, signs warning drivers to slow down were set up either side of the diversion area. Additional signs explaining the project were placed at the diversion area to inform members of the public what DOC was doing and why the public should still refrain from feeding the kea.

Kea monitoring

In September 2014 Corey Mosen of the KCT fitted transmitters onto three juvenile kea that frequented the ski field. An adult female with a nest near to the ski field road already had a transmitter fitted. Other females with transmitters are known to be in the surrounding area but were not considered to be targeted by the diversion project as they were either nesting on another range (e.g. the Raglan Range) or did not frequent the ski field (e.g. the pair nesting on western flank of St Arnaud Range). See figure 29 in *section 2.1.9 Kea nest protection* for locations of these kea nests protected by small trap networks.

Corey set up trail cameras outside known nest sites and periodically collected data from the transmitters of all kea able to be located. DOC staff/FOR volunteers servicing the diversion area checked for signals daily for all transmittered kea in the area, to establish whether they were nearby and if so what their status was. A trail camera was set up on 6th October to monitor the diversion site.

The pair nesting on the western flank of the St Arnaud Range was not considered to be targeted by the diversion area as they were not known to be "junk food" birds that frequented the ski field. The female of this pair was monitored periodically by Corey Mosen through transmitter signals, nest cameras and nest visits. The transmitter signal was also monitored intermittently by DOC Nelson Lakes staff.

Kea deterrence at loading zone

The possibility of kea interfering with helicopters and equipment at the ski field loading zone during the aerial operations was a concern, both in terms of potential damage to vital and expensive equipment and the risk to kea safety.

For the prefeed operation the helicopters arrived at the loading site on the evening prior to the operation. A DOC staff member was placed on 'kea patrol' that night, armed with a powerful watergun to fend off any kea investigating equipment too closely. Waterguns were also available at the loading site during the day of the operation.

For the toxic operation the helicopters did not arrive until the morning of the operation, so there was no night-time kea patrol but again waterguns were available at the loading zone during the operation.

Results

Details of daily diversion area servicing and kea monitoring are recorded in the "results" tab of excel spreadsheet *Kea diversion plan through 1080 2014* (DOC-1470230).

Kea attendance at diversion area

Due to the good fortune of encountering kea on the ski field road two days after the initiation of the diversion project, the diversion area was set up right in front of them so they were aware of its existence very early on.

Kea were then present at the diversion area 40% of the time that staff/volunteers visited and for which records are available (35 out of 87 days). Of the remaining 52 days, food had been taken on 48 days (92% of the time), signals from transmitters could be heard on 37 days (71%), kea were heard nearby on five days (9%) and kea were seen flying overhead on five days (9%). On four occasions the weather was too bad to allow safe servicing of the diversion area (4th October, 22nd November, 13th and 14th December).

On the day of the prefeed operation, five kea turned up at the diversion area at 0830 and stayed there until 1315, roughly an hour before the operation was completed. On the day of the toxic operation, six kea arrived at the diversion area at 0645 and stayed until 0845 after which kea were seen intermittently flying around the valley or sitting in nearby trees, and transmitter signals indicated all of the transmittered ski field birds were in the vicinity.

Kea presence at loading zone
Kea were not present at the loading zone during the night prior to the prefeed operation, however a couple did arrive at dawn and loitered on the ground in the area where the bait-carrying trucks were arriving. After being squirted with waterguns they left the area. No kea were seen at the loading zone before or during the toxic operation.

Trail camera results
The trail camera monitoring the diversion area did not provide information on specific individuals as bands could not generally be read on the resulting photos. The most kea observed at the same time in a camera photo before the operation was five, and five were also seen together in a camera photo taken after the operation.

The trail camera did however pick up things that we were not otherwise aware of: the fact that members of the public were walking up the ski field road and adding their own 'toys' to the frame as well as climbing on it and taking photos; and that a truck driver chose the diversion area as a place to urinate on leaving the loading zone following the toxic operation. Possums were occasionally seen climbing on the frame, but did not appear to be getting into the food hoppers.

Kea survival
Of the kea targeted by the diversion area, the three transmittered juvenile ski field kea survived the toxic operation and the one transmittered adult ski field kea lost its transmitter prior to the operation, but has been seen several times since in 2015 so is known to have survived.

Of the kea not targeted by the diversion area (as they did not frequent the ski field), the transmittered female nesting in the Raglan Range survived the operation, as did a pair living on Mt Robert who were not officially monitored as they were not transmittered and generally occupied an area outside the treatment area.

The female nesting on the MOR spur within the treatment area did not survive the operation. Initially it was thought that all monitored kea within the Nelson Lakes area had survived, as post-toxic operation monitoring resulted in "live" signals from all the transmittered birds known to be in the area. However, transmitters will only switch into "mortality" mode twenty-four hours after a bird has died since the switch is based on movement over a certain time period, so it is likely that although the kea had died, her transmitter had not yet switched into "mortality" mode. Later monitoring picked up the "mortality" signal and the body was recovered and sent to Massey University and Landcare Research for autopsy and toxicology testing respectively. These tests confirmed that ingestion of 1080 was the cause of death. Her mate continued to feed their chicks, and he and the three fledglings survived.

Discussion

The kea diversion project appeared to be successful at keeping kea away from the loading zone during operations, with kea leaving the loading zone in response to watergun squirts and then being present down at the diversion area for a large part of the day during the prefeed operation. No kea were present at the loading zone on the day of the toxic operation, but some were present at the diversion area in the morning.

The diversion area's effectiveness at protecting "junk food" ski field kea from eating 1080 pellets is unclear, as ultimately the treatment area was altered in the few days leading up to the toxic operation to exclude all alpine areas as a precautionary response to uncertainty about the fate of a rock wren population monitored through another 1080 operation elsewhere. This meant that the risk to the ski field kea was less than it would otherwise have been, but we cannot quantify this since kea roam far and wide so the ski field kea may still have entered the treated area and thus been at risk. Nevertheless, the three ski field juveniles survived along with at least two other untransmittered ski field kea.

The death of one breeding age female is a blow to the Nelson Lakes kea population, however the fact that her mate survived and reared their three chicks to fledging age during a mast year goes some way towards countering this loss (the first nesting attempt by this pair in 2014, prior to the aerial operation, failed due to rat predation of the eggs). It is acknowledged by DOC that individual kea are at risk from 1080 poisoning when aerial drops are carried out, however at a population level this loss is compensated by the landscape-scale pest control allowing for a good breeding season with fewer kea killed by stoats (Kemp et al. 2014, in Crowell, 2014).

DOC and the KCT monitor the nesting success of kea in Nelson Lakes every year, and monitoring is done at other sites as well to better determine the costs and benefits of aerial 1080 for kea. In total forty-eight kea were monitored through BFOB operations in 2014, at Nelson Lakes National Park, at Abbey Rocks in South Westland, in Kahurangi National Park, and in the Hawdon Valley in Arthur's Pass National Park. Of these, four kea died from 1080 poisoning: one at Abbey Rocks, two from the Oparara area in Kahurangi and one in Nelson Lakes.

In December 2014 a sub-adult kea was also found dead as road-kill on State Highway 63 between the Nelson turn-off and St Arnaud. This highlights the other current threats to kea from humans which include being hit by cars, lead poisoning and being shot with firearms, all of which do not confer any benefit to the population at all, unlike aerial pest control.

While 1080 does pose a risk to individual kea its use in landscape-scale pest control reduces the populations of the predators that are known to prey on kea eggs, chicks and even older birds, thus conferring overall population-level benefits. Therefore DOC and other organisations like the KCT will continue to work together to refine methods and develop tools that will reduce the risk posed to kea by aerial 1080, while continuing to provide protection from predators during nesting to allow population recovery.

The value of the diversion approach tested at Rainbow ski field in 2014 has not been conclusively confirmed by this trial due to the last-minute changes to the treatment area. However the trial has established that the use of diversion areas has the potential to be a useful tool, but that the effort required to maintain such areas can be substantial. Any future trials of a similar approach should investigate whether effort can be reduced without compromising kea health or diversion success, and whether the diversion area does reduce the likelihood of "junk food" kea ingesting 1080 pellets if those same kea are exposed to pellets in the alpine zone they inhabit.

A report was written on this trial (DOC-2551910) for distribution to the Friends of Rotoiti, the KCT and other interested parties, which this text is largely based on. The full report however has additional recommendations that should be considered if a similar diversionary approach is used again in the future.

2.1.3 Non-BFOB mustelid control

2.1.3.1 RNRP mustelid control

Introduction

Landscape-scale ground-based mustelid control has been carried out for many years at the RNRP. At the beginning of 2014/15 the two-year trial of self-resetting traps came to an end, with the last of the A24s being deactivated in July 2014 and the existing network of DOC200s being fully reactivated.

Ground-based mustelid control continued throughout 2014/15 despite the Battle For Our Birds aerial 1080 operation for several reasons: it was uncertain for a long time whether or not an aerial operation would be going ahead, trap-lines around St Arnaud village and in Big Bush protect areas that would not be within any aerial 1080 treatment area, and because a combination of trapping and aerial 1080 could potentially be more effective than either control method used alone, with the original intention being to use tracking tunnel data from the different treatment blocks to investigate this (see *section 2.1.2.4 BFOB mustelid control and monitoring*).

The aim of ongoing ground-based mustelid control is to suppress mustelids to a tracking rate below 5%, the target that is considered to enable kākā and other native birds to breed successfully (Greene et al. 2004; Taylor et al. 2009). The Friends of Rotoiti (FOR) community group also maintains several trap lines in areas outside the RNRP, which act as a buffer), helping minimise reinvasion (see *section 2.1.3.2 FOR mustelid control*)

Methods

RNRP mustelid trap lines cover approximately 5,000 ha to the east and north of Lake Rotoiti. There are a total of 907 single-set traps spaced 100m apart along twenty-four trap lines. The majority of these are DOC200 traps, with ninety-two DOC250 traps spread along lines adjacent to farmland in order to target ferrets. The wooden trapboxes are a FOR design that hinges open at one end, and meet "best practice" standards for use in areas where weka and kiwi are present.

In 2014/15 the traps were baited with brown hen's eggs year-round, with the addition of salted rabbit to all traps in January and again to the DOC250s in May.

Trap check frequency was intended to be monthly at first, moving to fortnightly in November in response to high catch rates during the beech mast-fuelled rat and stoat plagues, then back to monthly at such time when catch rates had reduced to "normal" levels once again. In practice, a lack of resources led to trap checks not being carried out as frequently as was planned, the schedule reverting to monthly checks in late February, much earlier than was originally intended.

Results

The spatial distribution of mustelid captures over the four seasons in 2014/15 are shown in figures 14-17. Total number of catches, including by-catch species, and sprung traps are shown in table 4. In table 4 "Other" consists of one weka, one blackbird, and one unidentified animal.

Table 4. Number of catches and sprung traps in RNRP stoat traps in 2014/15.

Species	Number caught
Stoat (*Mustela erminea*)	275
Ferret (*Mustela furo*)	4
Weasel (*Mustela nivalis*)	87
Rat (*Rattus* sp.)	1760
Mouse (*Mus musculus*)	52
Hedgehog (*Erinaceus europaeus*)	143
Rabbit (*Oryctolagus cuniculus*)	50
Cat (*Felis catus*)	19
Other	3
Sprung	511

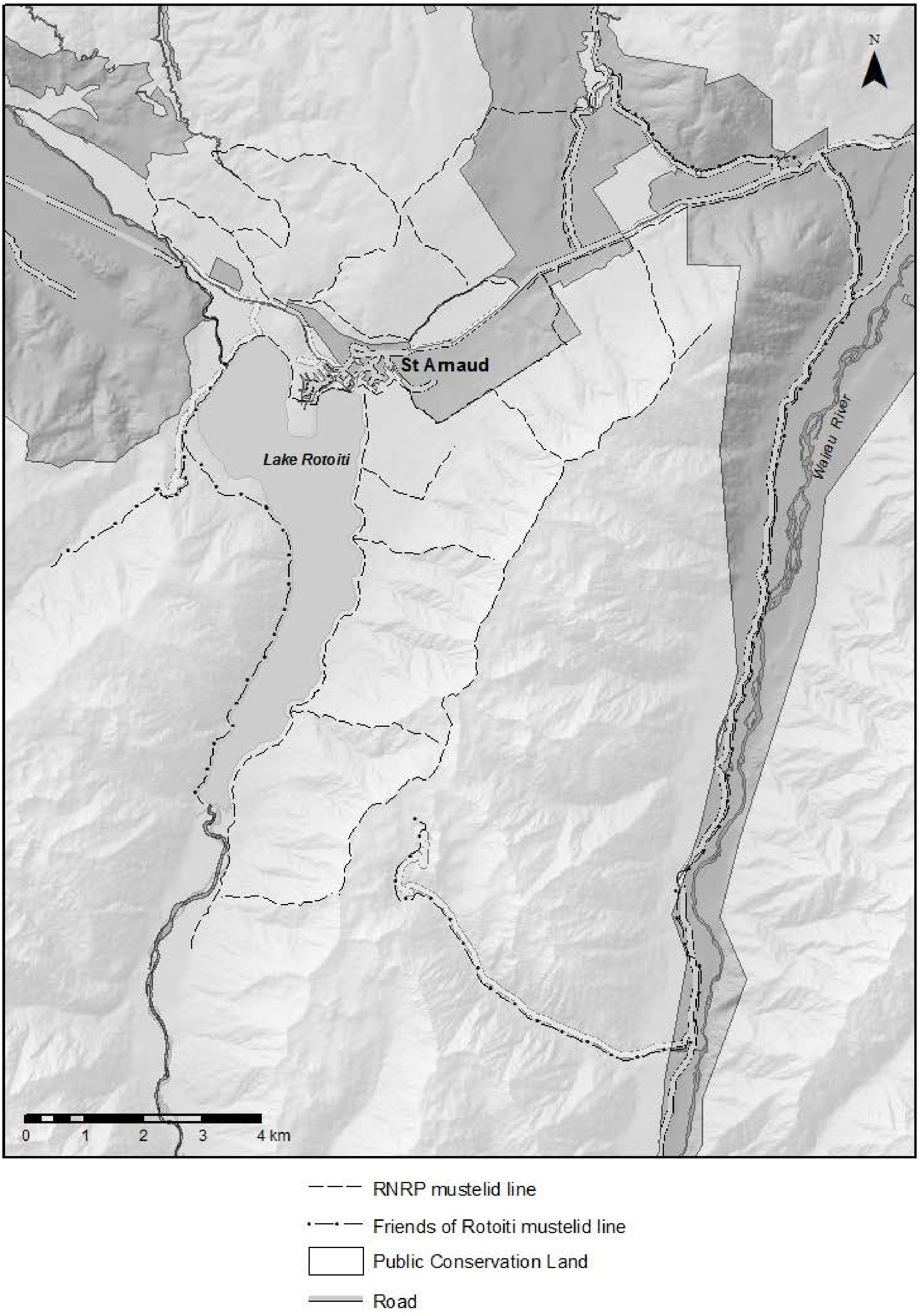


Figure 13. Location of the RNRP and Friends of Rotoiti mustelid trap lines in 2014/15.

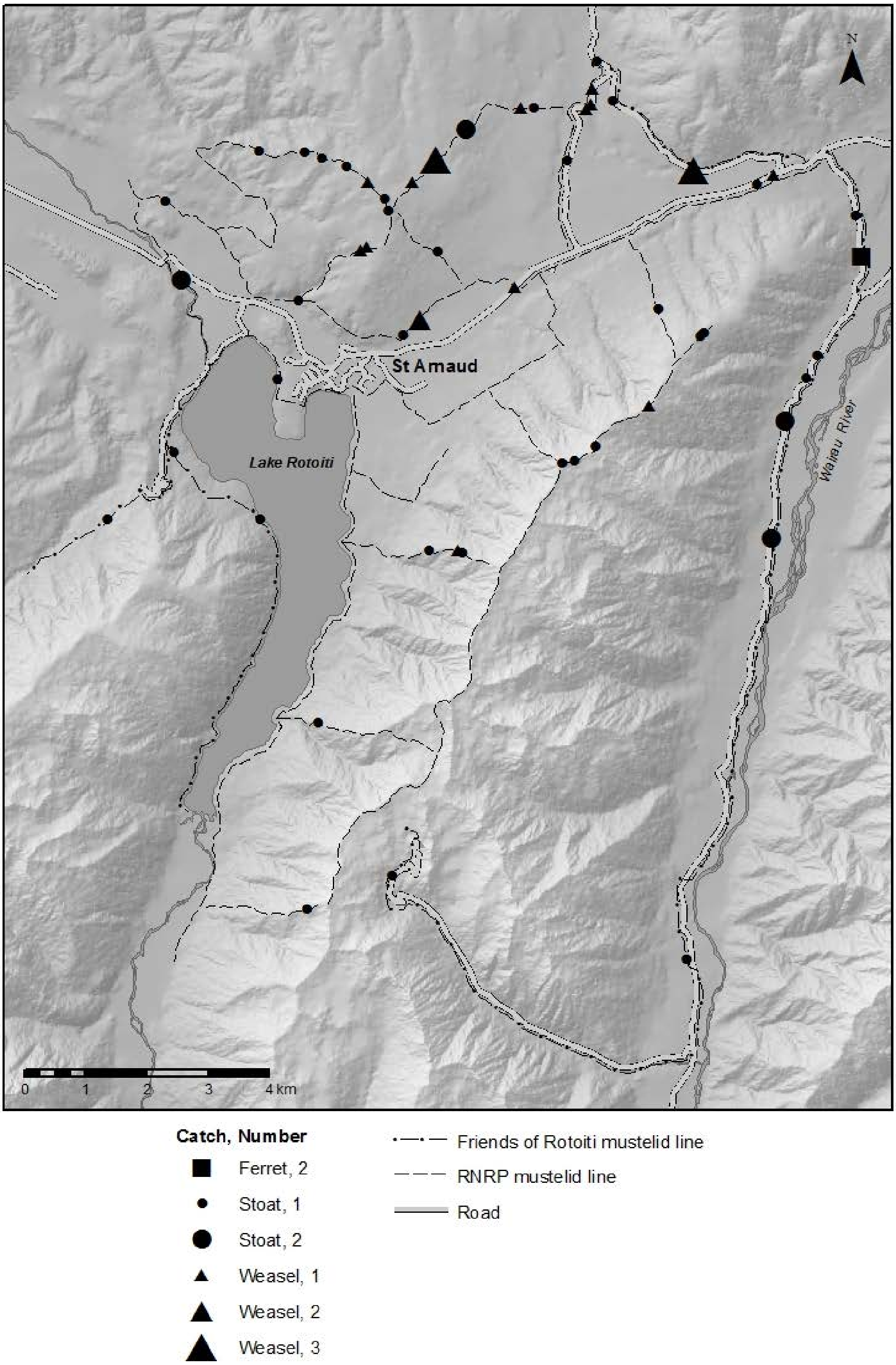


Figure 14. Mustelid captures along the RNRP and Friends of Rotoiti stoat trap lines during September-November 2014.

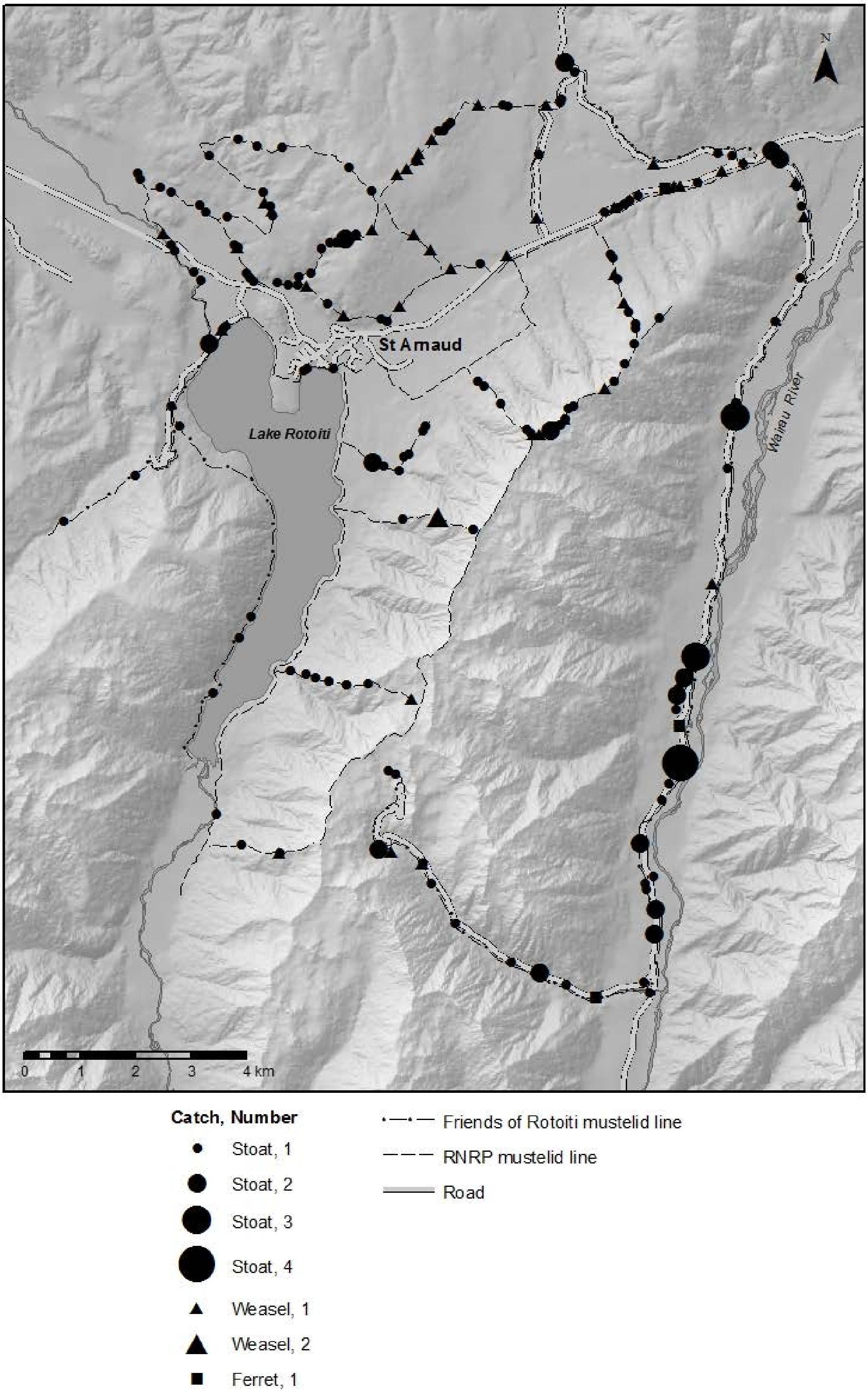


Figure 15. Mustelid captures along the RNRP and Friends of Rotoiti stoat trap lines during December 2014-February 2015.

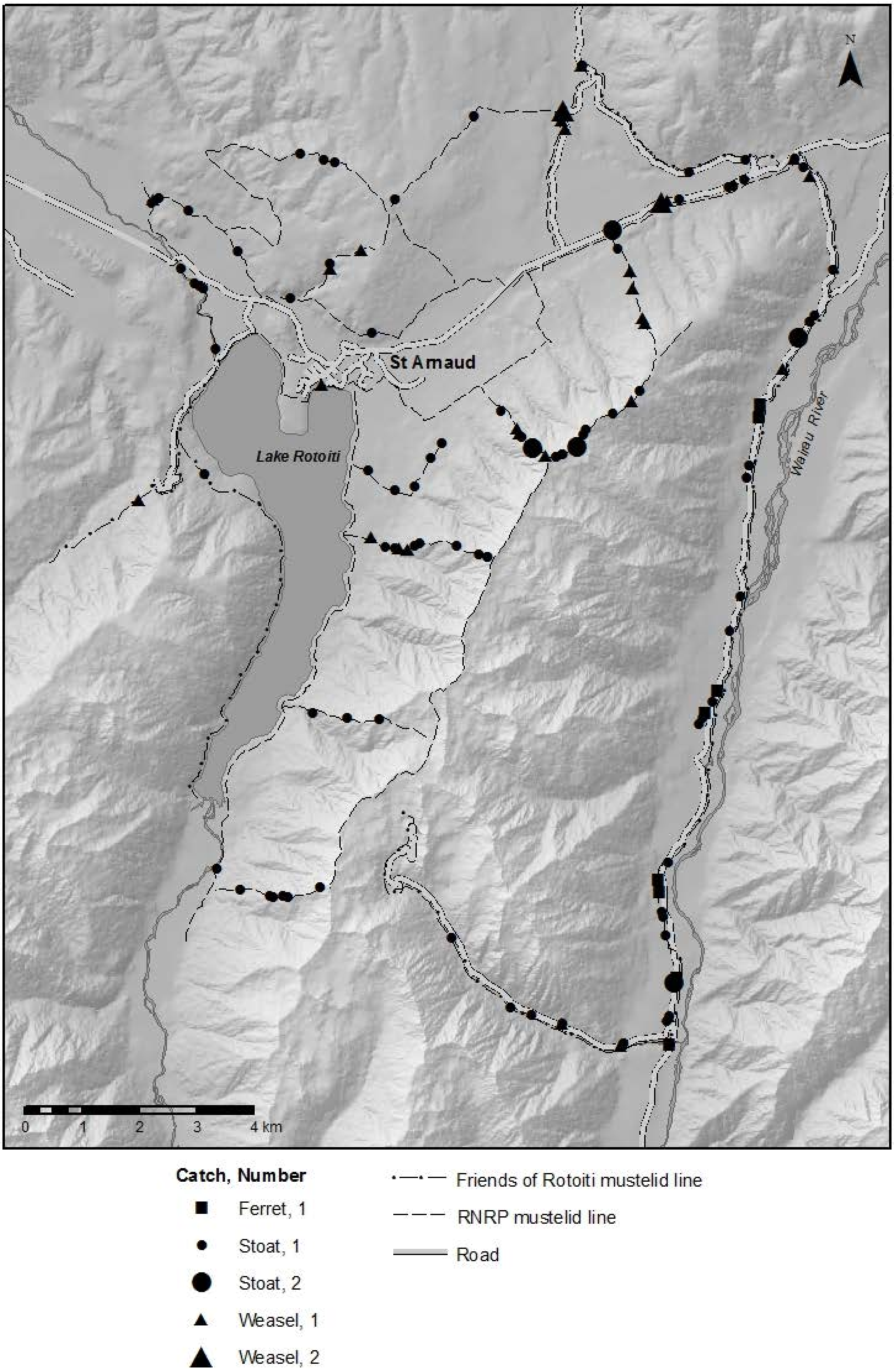


Figure 16. Mustelid captures along the RNRP and Friends of Rotoiti stoat trap lines during March-May 2015.

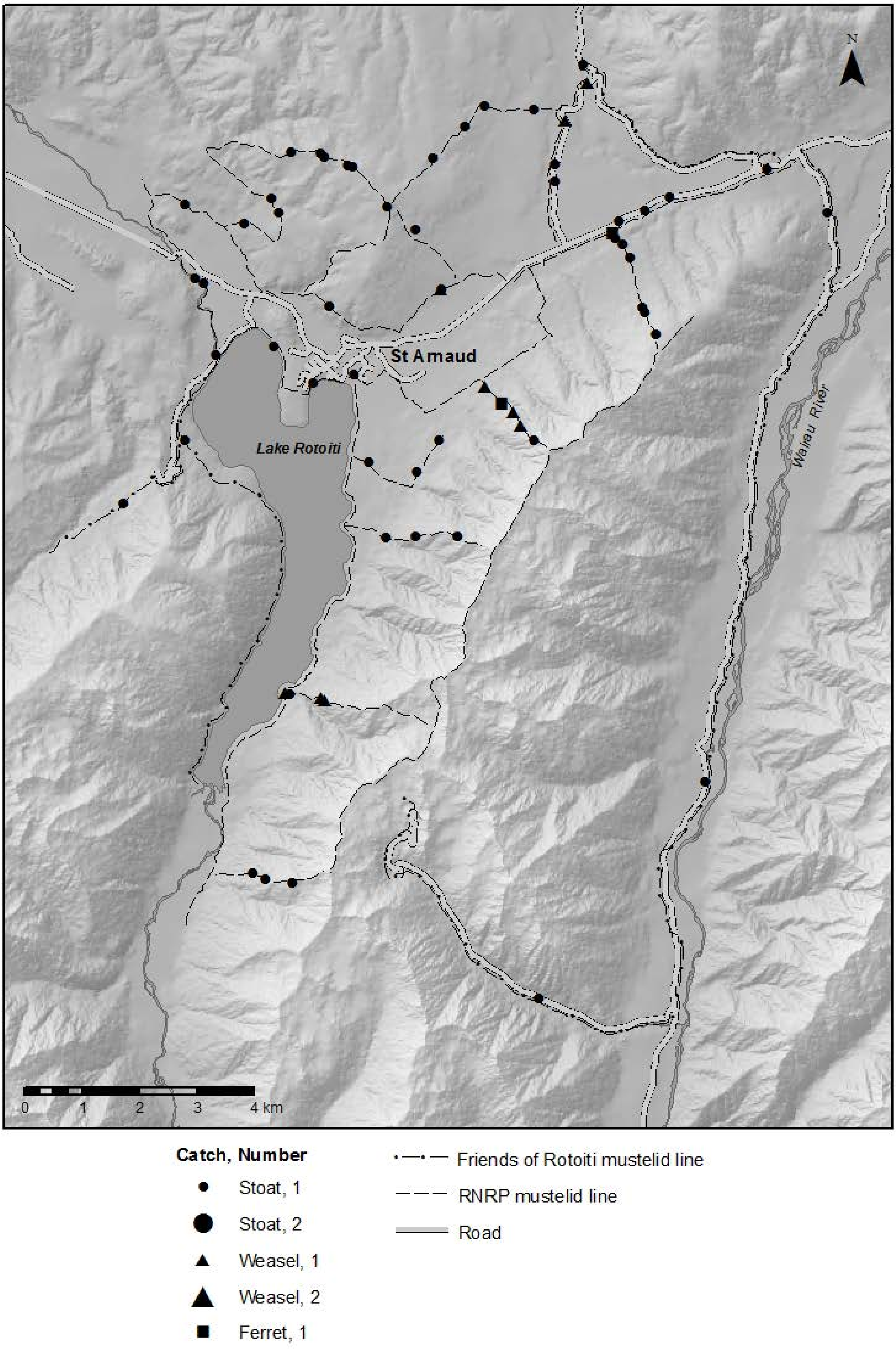


Figure 17. Mustelid captures along the RNRP and Friends of Rotoiti stoat trap lines during July-August 2014 and June 2015.

Discussion

While exceptionally high numbers of mustelids have been caught in DOC traps in 2014/15, unfortunately due to constraints on staff time mustelid monitoring was not as thorough this year as in previous years, so the impact of the RNRP stoat trap network and the BFOB aerial 1080 operation on the local mustelid population is not clear.

The catch results do demonstrate how trap networks can be overwhelmed during post-mast rat and stoat plagues. For example comparing catch results between 2014/15 and 2011/12, when a similar DOC-series trapping regime was in place: rats - 1760 in 2014/15 vs 460 in 2011/12, stoats - 275 vs 164, weasels - 87 vs 8. Although these numbers do not take into account trap-check frequency, which is likely to have been higher in the 2014/15 mast year in order to try to keep traps clear of rats so they could catch stoats, they provide some idea of the difficulty of maintaining low stoat numbers using traps when there are orders of magnitude more rats around than usual who fill up traps that can then no longer catch stoats, as well as providing a bountiful food supply for stoats who are therefore likely to be less motivated to go into a trap.

2.1.3.2 Friends of Rotoiti mustelid control

Methods

Mustelid trap lines have been maintained by the Friends of Rotoiti (FOR) as a buffer to the RNRP, with a total of 292 DOC200 and 106 DOC250 traps in operation:

- Rainbow Valley / Six Mile / Dip Flat Line: 55 DOC200s and 106 DOC250s.
  In 2014/15 FOR assisted a bait-less run-through trial being carried out in the Rainbow Valley. The DOC250 traps previously on this line were removed for the duration of this trial and replaced with "standard" DOC200s alternating with run-through DOC200s up to trap 153. This trial is due to finish August 2015. The Six Mile and Dip Flat lines each have four DOC 200s.
- Seasonal Rainbow Ski Field Line: 70 DOC250s (these traps have usually been DOC200s but were replaced with DOC250s during the run-through trial). These traps are put out in mid to late October to run through the summer months (exact timing is

always seasonally dependent on when the snow falls at the beginning of the season and when the ski field closes at the end of the season).

- Mt Robert Line: 18 DOC200s.
- Whisky Falls Line: 82 DOC200s.
- Tophouse Road Line: 43 DOC200s.
- Speargrass Line: 24 DOC200s.

The Mt Robert, Speargrass, Whisky Falls and Tophouse Road lines are checked fortnightly from October to April and monthly from May to September. The Rainbow Valley, Dip Flat, Six Mile and Rainbow Ski field lines are checked weekly or fortnightly from October to April, and fortnightly or monthly during the colder months depending on catches.

Polymer baits (from Trappers Cyanide Ltd) are used, and baits are changed every eight weeks.

A bait-less run-through trial was started in August 2013, to compare results from unbaited run-through traps with baited standard DOC200 traps. The trial includes trap numbers 1 – 153 on the Rainbow Valley trap line. In the first year even-numbered traps were run-through traps, and odd-numbered traps baited until August 2014, when this was switched for the second year of the trial. The trial will finish in August 2015.

Results

The spatial distribution of mustelid captures along FOR trap lines are shown in figures 14-17, the distribution of FOR mustelid captures by month is shown in figure 18 and non-target species caught as bycatch in the FOR mustelid traps are summarised in table 5.

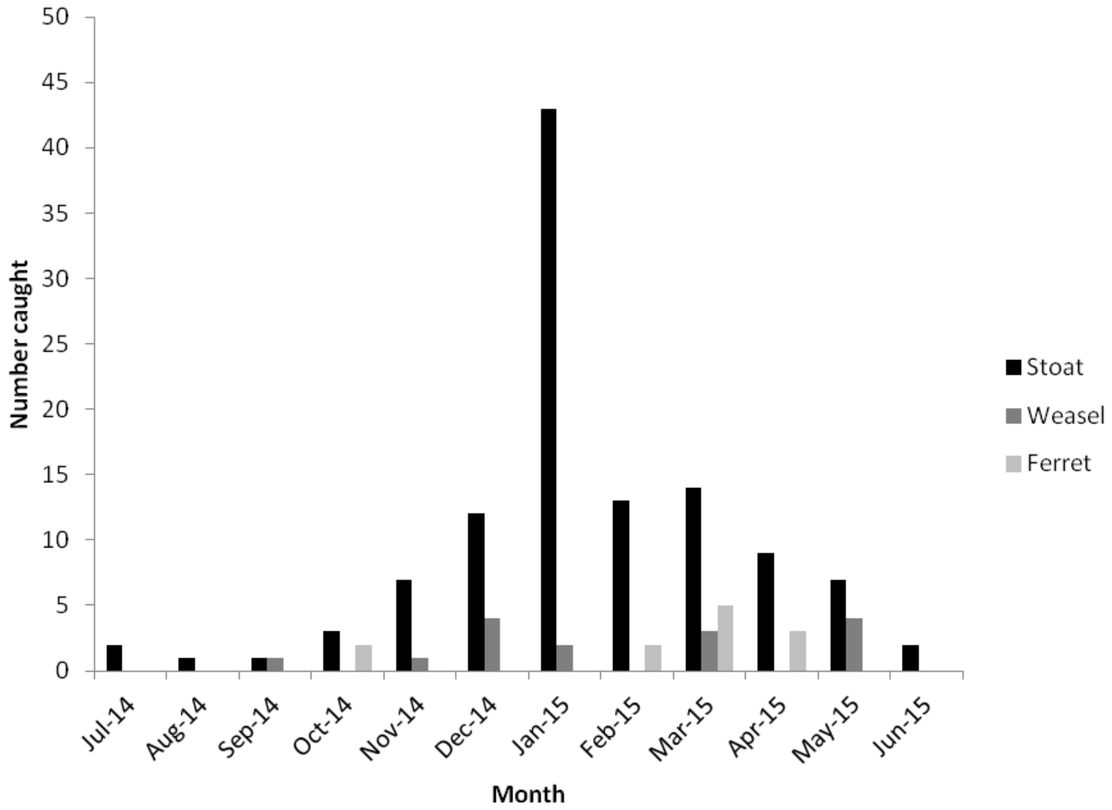


Figure 18. Mustelid captures on Friends of Rotoiti mustelid trap lines in 2014/15 by month.

Table 5. Non-target captures on Friends of Rotoiti mustelid trap lines in 2014/15.

Species	Number caught
Hedgehogs (*Erinaceus europaeus*)	61
Rats (*Rattus* spp.)	979
Rabbits (*Oryctolagus cuniculus*)	17
Cats (*Felis catus*)	12
Mice (*Mus musculus*)	46
Birds	3

All birds caught were exotic: a sparrow (*Passer domesticus*), a song thrush (*Turdus philomelos*) and a starling (*Sturnus vulgaris*).

2.1.4 Feral cat control

2.1.4.1 RNRP feral cat control

Methods: control

In 2014/15, eighteen Havahart™ cage traps were used to control feral cats in and around the RNRP. Cage trapping was undertaken over 1st August-10th October up Mt Robert Road and in Teetotal, over 7th-23rd January in West Bay and over 13th April-14th May in various locations within the RNRP core.
Traps were baited with fish frames, fresh rabbit or salted rabbit and were left wired open for a few days prior to being set to allow cats to get used to them. Cats were dispatched with a .22 rifle. In the April trapping period baits were changed less frequently than in previous years (weekly instead of every three days).

This season local DOC staff tested the idea of re-using old transmitters that had been removed from monitored birds to allow remote monitoring of cage traps using telemetry equipment. The second-hand transmitters were customised in-house by a staff member with an engineering background, these transmitters were attached to poles beside cage traps and connected to a mercury switch on the cage trap door so that the signal sent would indicate whether the trap had gone off or not. The transmittered traps were only open for five nights (giving a total of thirty trap nights with no cats caught) before they were pulled in for more work.

The first design did not have enough signal range for staff to be able to check the transmitters without being out on Lake Rotoiti in the boat, which greatly increased the amount of time needed to check traps. Trialling different transmitter types with different aerial configurations it was found that old kākā, kea and whio transmitters gave a signal with the best range that could be picked up from the office, eliminating the need to put the boat in the lake. Unfortunately these old transmitters were all duty cycle types which would necessitate the co-ordination of trap set-up and re-setting of traps after catches to ensure the transmitters would be putting out signals at the appropriate time of day for trap checks. Kiwi transmitters, while having the advantage of not having a duty cycle, did not have as good a range. These remain a work in progress.

In addition to cage trapping, raised-set Timms traps were again deployed this season, to provide continuous and less labour-intensive cat control. Twelve Timms traps were set on a 200 mm-wide board 1.2 m above ground level (to remove the risk to ground-dwelling birds such as weka) along existing stoat trapping lines, and were checked and re-baited with salted rabbit meat concurrently with stoat trap checks either fortnightly or monthly.

The DOC-series stoat trap network also caught cats, although they were not the target. See *section 2.1.3.1 RNRP mustelid control* for details on the RNRP stoat trap network.

Methods: monitoring

Trail cameras were trialled to see if they have potential as a mark-recapture method of estimating cat densities. Only a small pilot was run to investigate bait placement and whether individual cats could be identified from video and still photos. Three cameras were set up around the Lakehead area to monitor a piece of fresh rabbit meat pegged into the ground over a period of twenty-eight days.

Results

Cat control

In total, twenty-seven feral cats were removed from the Mainland Island this season across all methods (see figure 19 and table 6). One further cat was caught live in the entry baffle of a DOC200 on the Snail Ridge but was released. This is more than in 2013/14 when only eleven cats were captured, but similar to other years prior to that.

Table 6. RNRP cat captures in 2014/15

Trap type	Number of cats caught
Timms	0
DOC200	10
DOC250	8
Cage	9

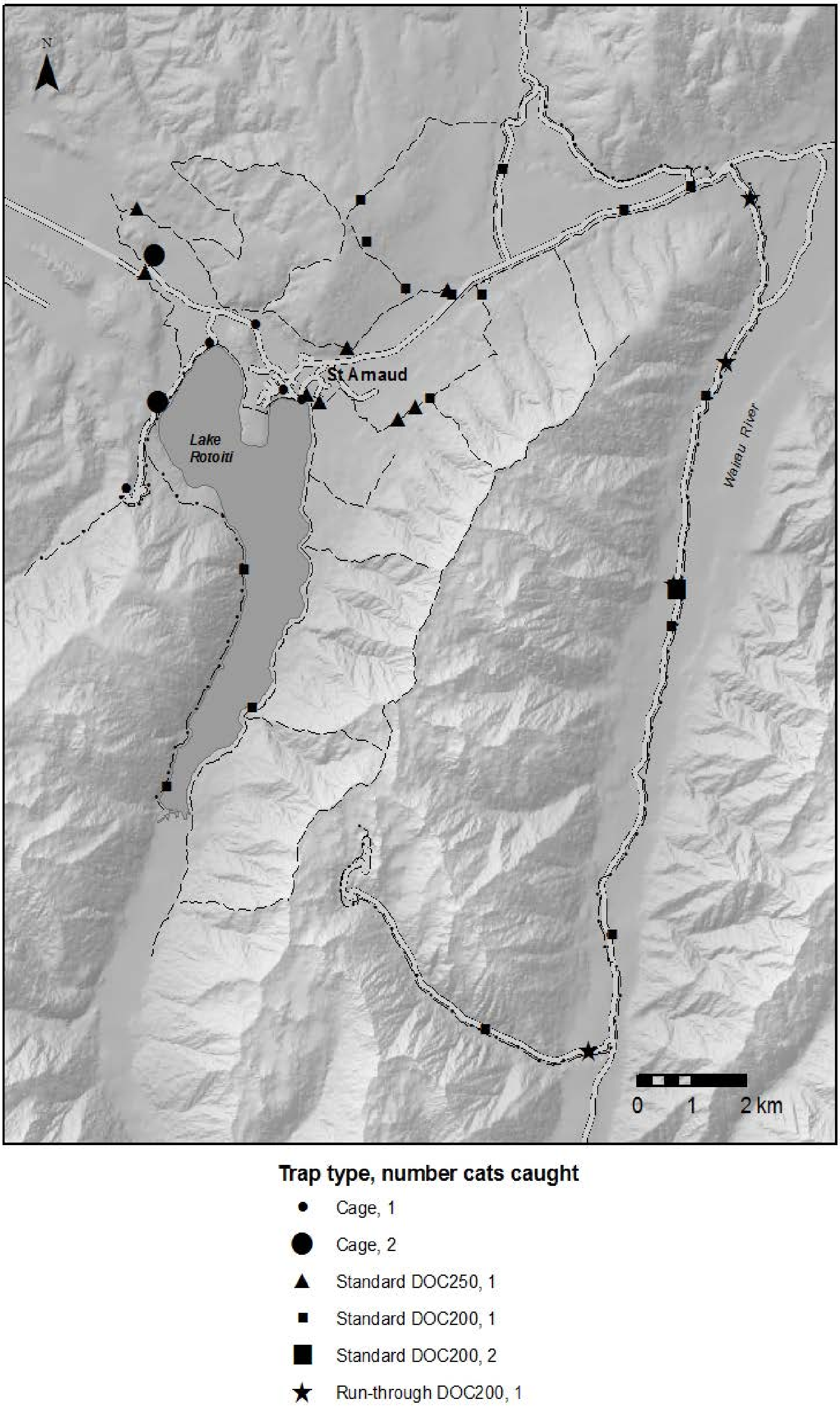


Figure 19. RNRP and Friends of Rotoiti feral cat captures in 2014/15 by trap type.

Table 7. Cat cage trapping results for given effort around RNRP in 2014/15

Trapping period	Location	Number traps	Number cats caught	Number non-targets caught	Catch per trap night	Catch per unit effort
August-October	Mt Robert & Teetotal	8-9	2	4	1/104 nights	1/138 trap visits
January	West Bay	3-4	0	0	0/34 nights	0/44 trap visits
April-May	RNRP core/lakeside	7-12	6	2	1/32 nights	1/42 trap visits

August-October results: Two cats were caught using cage traps. Cage traps were open for 208 trap nights (# traps × # nights open), giving a catch per trap night of one cat per 104 nights. The catch per unit effort (CPUE) was recorded as 276 trap visits giving a CPUE of one cat per 138 trap visits. Four non-target species were caught in this round of trapping; two hedgehogs which were released and a female possum with a joey which were shot.

January trapping: Cage traps were open for thirty-four trap nights in the West Bay campground in response to sightings of cats. Traps were visited forty-four times but no cats were caught.

April–May trapping: Six cats were caught using cage traps. Cage traps were open for 193 trap nights giving a catch per trap night (CPTN) of one cat per 32.2 trap nights. The amount of effort required for these traps was recorded, with 36.2 hours spent setting up and checking traps giving a CPUE of one cat per 6.03 hours. Alternatively, measuring by visit rather than by hour, cages were visited 251 times giving a CPUE of one cat per 41.8 visits. Two non-target species were caught; a juvenile male possum in Kerr Bay which was shot, and a male weka which was caught later in the same trap and released.

One additional cat was caught when a trap was spontaneously put out baited with sardines on toast after it was sighted at the DOC tea rooms. This cat is included in table 6 but not in table 7 as it was not part of the planned RNRP cat control.

A variety of bait types was used to target cats. As seen in table 8 the number of trap-nights per cat caught was lower for traps baited with fish frames than with salted rabbit in the April trapping period. The average number of trap-nights following a bait change at which a cat was caught was also lower for fish frames (figure 20). The sample size is very small, therefore the difference is not statistically significant and conclusions should not be drawn from these results on their own (see the *Discussion* section).

Table 8. Catch rates with different bait types from RNRP cat cage trapping in 2014/15

Bait Type:	Salted rabbit			Fresh Rabbit			Fish Frames		
Month	Trap-nights	# cats caught	Trap-nights per cat	Trap-nights	# cats caught	Trap-nights per cat	Trap-nights	# cats caught	Trap-nights per cat
August	~	~	~	72	0	~	28	2	14
January	~	~	~	19	0	~	15	0	~
April	150	4	37.5	~	~	~	43	2	21.5

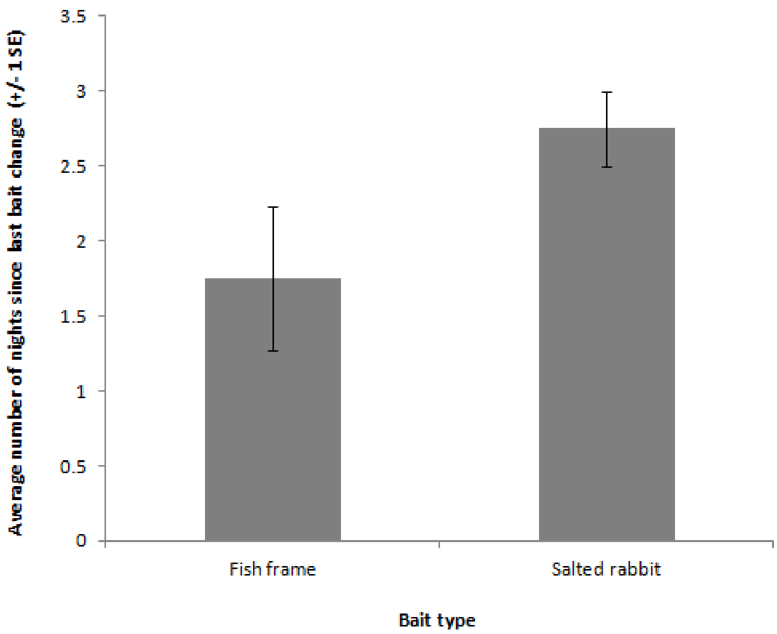


Figure 20. The average number of nights following a bait change at which cats were caught in RNRP cage trapping 2014/15. T-test P = 0.095.

No cats were caught in the raised set Timms traps this year, however one ship rat and one possum were caught.

Eighteen cats were captured as non-target by-catch in the DOC-series trap network targeting stoats; ten in DOC200s and eight in DOC250s. Of these, sixteen were caught in traps having hen's eggs as bait, and two in traps having a combination of salted rabbit and eggs.

For the fourteen captures where age was recorded there were seven adults, six juveniles and one kitten. For the twelve captures where sex was recorded nine were female and three male.

Cat monitoring

The trail cameras set up as a pilot study for a cat monitoring method recorded cats on three occasions. It was difficult to tell from the footage but it appeared to be the same cat each time, based on its size and colour pattern. This gives a rate of twenty-seven nights of camera monitoring per cat observation.

Discussion

The effort put into cat trapping this season for cage trapping was greater than previous years with cages put out in August, January and April, as compared to April-only effort in past years. The effort put into the April cage trapping was similar to previous years with traps visited 251 times (compared to e.g. 288 visits in 2012/13). However, in 2014/15 different areas were targeted in April than in previous seasons, with no cage trapping around Lakehead except for during the one week of testing transmittered cage traps.

Less effort was put into Timms trapping in 2014/15, with these traps shifted onto stoat trap lines at the start of April and included in stoat trap checks to reduce the amount of effort required. Even if the Timms traps catch low numbers of cats, the effort required to maintain these is minimal with each trap adding only ~five minutes effort to a stoat line each check. No cats have been caught in the three months they have been used in this way in the RNRP so far, but a greater period of time should be allowed to trial these to determine if they are a useful tool to continue with. Records should be kept of Catch Per Unit Effort for both trap types in 2015/16 to allow a more robust comparison in the future.

When trying to compare catches in cage traps by bait type the sample size is very small, and the traps were not laid out as they would be in a proper scientific trial, so the results seen in figure 20 and table 8 should be interpreted with caution. However, the results suggest that there is a possibility that fish frames are a more attractive bait than salted rabbit, and this could therefore be worth investigating more rigorously in the future to determine the best bait to use for cat cage trapping in the RNRP. If such a trial is done in the future, it should include recording how many nights a bait has been out for since it was refreshed, as this might become more relevant if traps no longer have to be checked daily if the remote monitoring of cage traps becomes a reality.

The use of transmitters to allow remote checking of cage traps was trialled for one week around the southern end of Lake Rotoiti in April before the transmitters were pulled in for improvements. This method would considerably reduce the amount of effort required to carry out cat cage trapping since live-capture traps must currently be checked in person daily. The recycling of old transmitters for this purpose is a work in progress that has the potential to considerably improve the RNRP cat trapping programme, either allowing for an expansion of trapping for the same amount of effort, or enabling the current level of cat control to continue while occupying less staff time.

2.1.4.2 Friends of Rotoiti feral cat control

Methods

Cats are often caught as by-catch in FOR mustelid traps particularly on the Rainbow and Whisky trap lines. A number of local volunteers also maintain their own live-capture cage traps targeting cats at points around the St Arnaud village and Tophouse Road area. In August 2014 a separate cat control operation was also carried out over twenty-two consecutive days in the Rainbow Valley using live capture traps.

Results

Five cats were caught during the August 2014 cat control operation using live-capture cage traps in the Rainbow Valley.

Twelve cats were caught as by-catch in FOR mustelid traps, ten in Rainbow Valley and two along Whisky line.

The targeted cage trapping by local volunteers caught 102 feral cats during 2014/15.

2.1.5 Non-BFOB possum control and monitoring

2.1.5.1 RNRP possum control and monitoring

Introduction

Ground-based possum control has been carried out for many years in the RNRP using traps. This trapping programme continued throughout 2014/15 despite the BFOB aerial 1080 operation being considered to provide possum control (see *section 2.1.2.5 BFOB possum control and monitoring*) for several reasons: it was uncertain for a long time whether or not an aerial operation would be going ahead, and trap-lines in Big Bush and the northern end of the St Arnaud Range protect areas that would not be within the aerial 1080 treatment area.

Methods: control

In 2014/15, the RNRP possum trap network was unchanged from that of 2013/14 (see figure 21), using Sentinel traps attached to trees ~1.5m above ground level, with white coreflute covers to help prevent non-target bycatch.

Trap spacing along some trap lines (Borlase Boundary, SARN, Duckpond stream, Black Sheep Gully, Struth, and a short length of Dome Ridge) is 200m; at every second stoat trap site. All other RNRP possum traps are at 100m spacing, generally co-located with RNRP stoat traps below bushline.

The lure regime in 2014/15 was the same as in recent previous years with a combination of Connovation's Ferafeed Smooth in a Tube lure on the tree leading up to the trap, and Trappers Cyanide Ltd's Possum Dough on the bait clip attached to the trap.

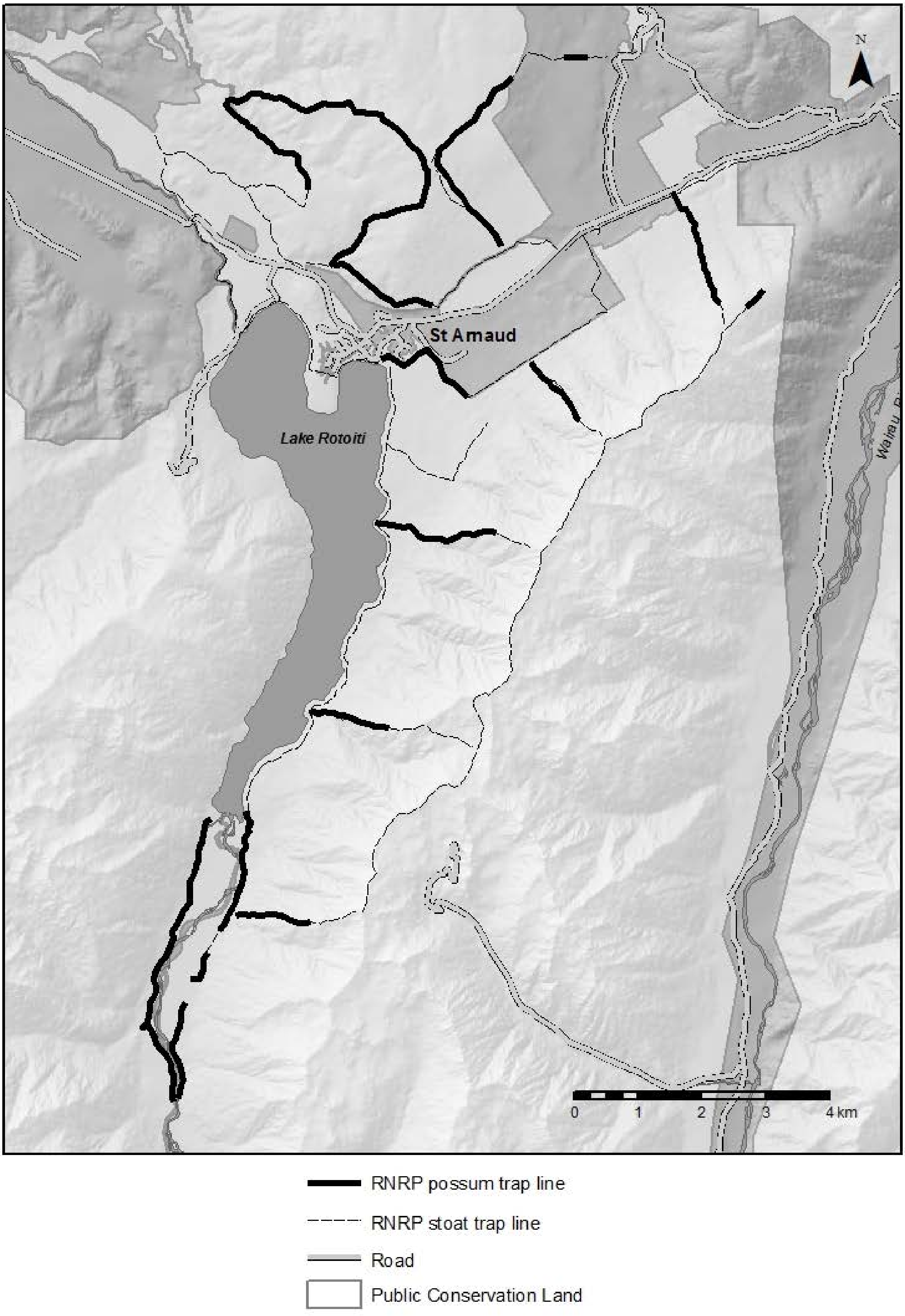


Figure 21. Location of RNRP possum trap lines in 2014/15.

Methods: monitoring

Regular RNRP possum population monitoring was undertaken this year during March 2015. This monitoring was completed following the National Possum Control Agency's (NPCA) waxtag seven-night survey method, and would have gone ahead regardless of whether or not the BFOB operation took place because it is part of a long-term possum monitoring programme to assess the effect of RNRP possum control efforts.

Lines of twenty waxtags were put out, fourteen lines on a compass bearing of 38 degrees in Big Bush, and thirteen lines on a bearing of 260 degrees in the RNRP Core on the St Arnaud Range. The start points were the same as used in previous years of waxtag monitoring. The tags used were orange in colour, with an unflavoured wax, and glow-in-the dark plastic tabs added at the attachment point.

Results

Prior to the BFOB aerial 1080 operation on 3rd December the two Travers Valley possum trap lines Lakehead and Coldwater caught far more possums than other RNRP trap lines (see figure 22), as has been the case ever since those two lines were established in 2012/13. This demonstrates the level of reinvasion pressure to the RNRP from the previously untreated Travers Valley. Following the BFOB operation, possum catches in the trapping-only Big Bush area increased, whereas catches on the two Travers Valley lines decreased markedly (see figure 23), with no possums caught at all on these lines until March 2015.

The Possum Activity Index (PAI) resulting from the regular RNRP waxtag monitoring was 6% in Big Bush, and 1% in the Core area. The weather was fine throughout the operation. This compares favourably to results from previous monitoring, although note it was done in March this year instead of May/June as in previous years. In the most recent 2012 measure, a PAI of 0% in the Core and 15% in Big Bush was recorded, indicating that possum activity has decreased in Big Bush, and stayed very low in the Core.

Table 9. Possum catches on RNRP possum trap lines in 2014/15.

Trapline	Total Possums caught	No. of traps	Catch per trap
Black sheep gully	7	13	0.54
Black Valley Stream	8	19	0.42
Dogleg	8	23	0.35
Struth	3	9	0.33
Duckpond Stream	6	10	0.6
Dome Ridge	15	45	0.33
Big Bush Total	27	119	0.35
SARN	0	3	0
Borlase Boundary	1	14	0.07
Grunt	5	23	0.22
Hubcap	8	23	0.35
MOR	12	17	0.71
Snail	2	15	0.13
Clearwater	21	17	1.24
RNRP St Arnaud Range Total	69	112	0.46
Lakehead	69	45	1.53
Coldwater	52	49	1.06
Travers Valley Total	121	94	1.29
Total	217	325	0.67

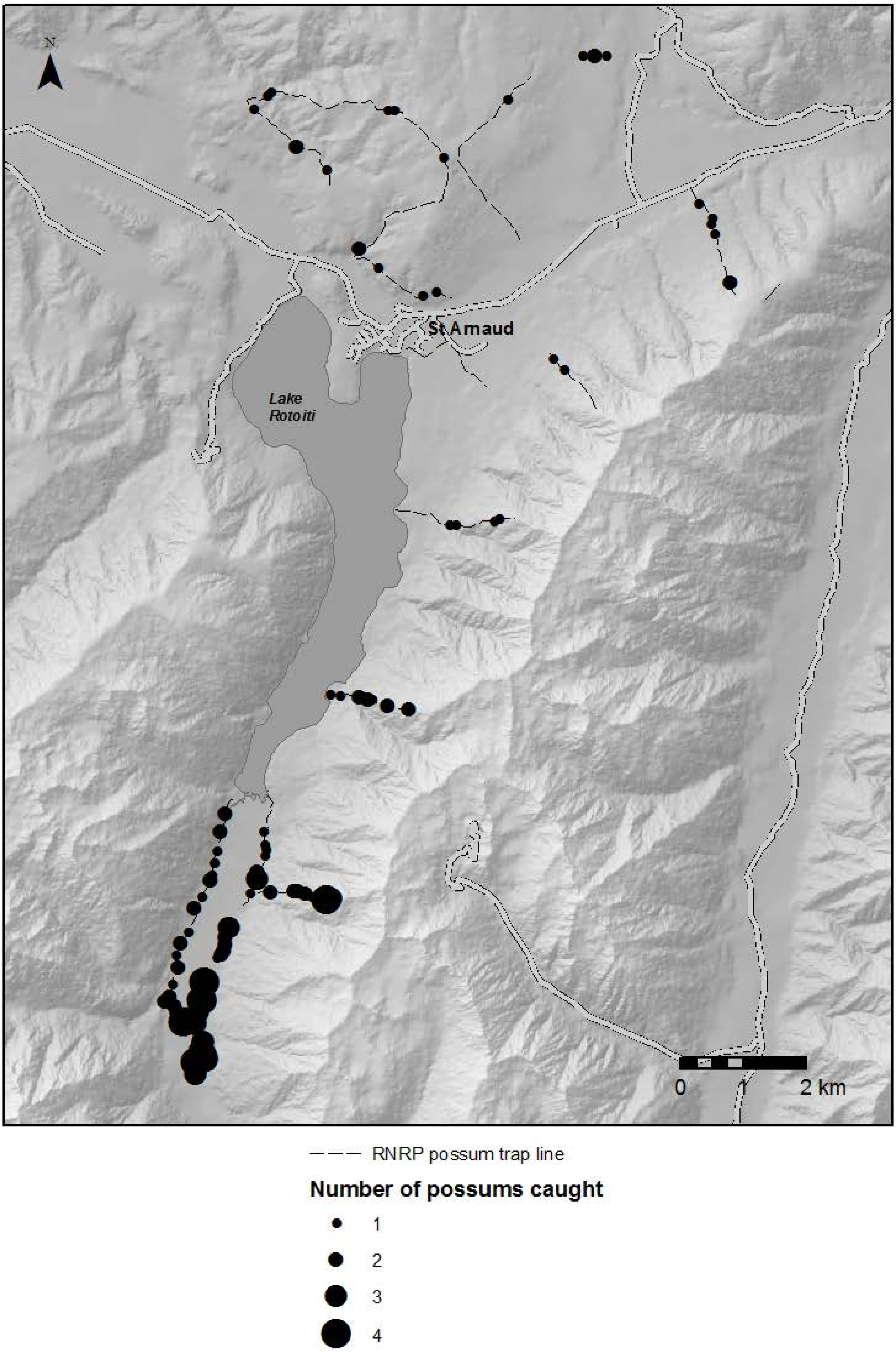


Figure 22. Possums caught in RNRP traps prior to the Rotoiti Battle For Our Birds operation, 2014/15.

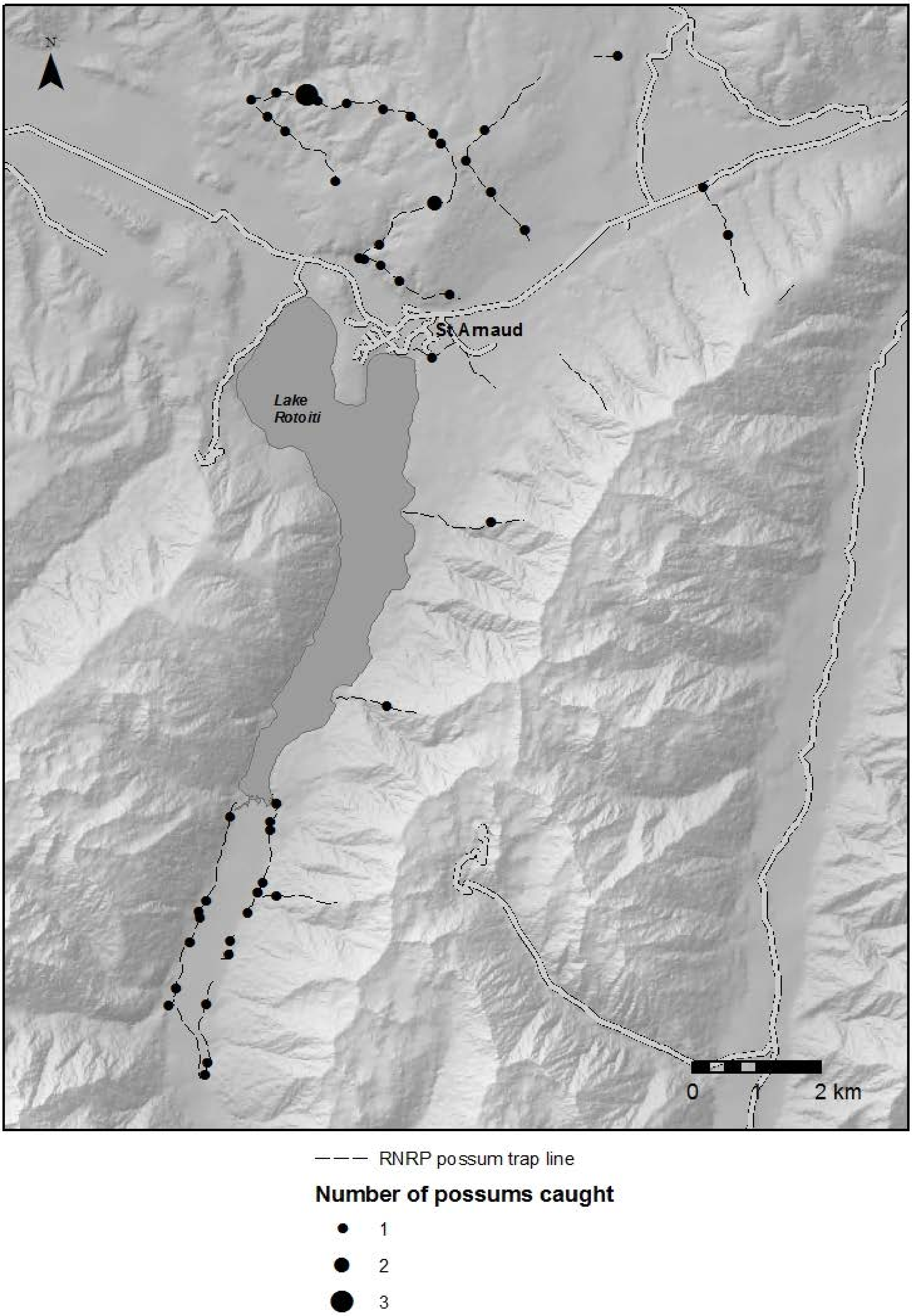


Figure 23. Possums caught in RNRP traps after the Rotoiti Battle For Our Birds operation, 2014/15.

Discussion

The low total catch rate on possum trap lines this year is likely to be largely due to the 2014 BFOB 1080 operation. This operation treated the majority of the Travers Valley, which is where over 60% of the 596 captures in 2013/14 came from.

Possum waxtag monitoring further up the Travers valley recorded a reduction in the PAI following the BFOB operation (see *section 2.1.2.5 BFOB possum control and monitoring*), and an instant reduction in number of possum kills was observed on trap lines within the BFOB treatment area following the aerial operation over the months when the majority of catches have occurred in the past.

The low waxtag monitoring result in the RNRP core was consistent with expectations, since the core area has historically had low numbers of possums and possum trapping continues to catch low numbers of possums in this area. The improvement in possum activity in Big Bush since the last monitor in 2012 indicates that the Big Bush possum trapping regime, which was only implemented in 2012/13, is having a beneficial effect.

2.1.5.3 Friends of Rotoiti possum control

Methods

Friends of Rotoiti possum control started with Warrior kill traps in 2005, which were changed to Sentinel traps early in 2010. The number of traps across various lines has been increased over the years. Currently there are thirty-seven traps in the Rainbow Valley, fifteen on the Whisky Falls line, ten on the Speargrass line and four on the Mt Robert road line. One Trapinator possum trap is being used on the Speargrass line.

Peanut Butter, Ferafeed (Connovation Ltd), Possum Dough (Trappers Cyanide Ltd) and Possum Paste (Goodnature Ltd) were all used as lures in the Sentinel kill traps at different times.

Results

In 2014/15, 145 possums were caught, which is fewer than in 2013/14 (235), however this does not take into account any variation in effort between the years. Spatial distribution of catches is shown in figure 24 and catch numbers by month are shown in figure 25. The highest total catch in a month was in March 2015 (twenty possums).

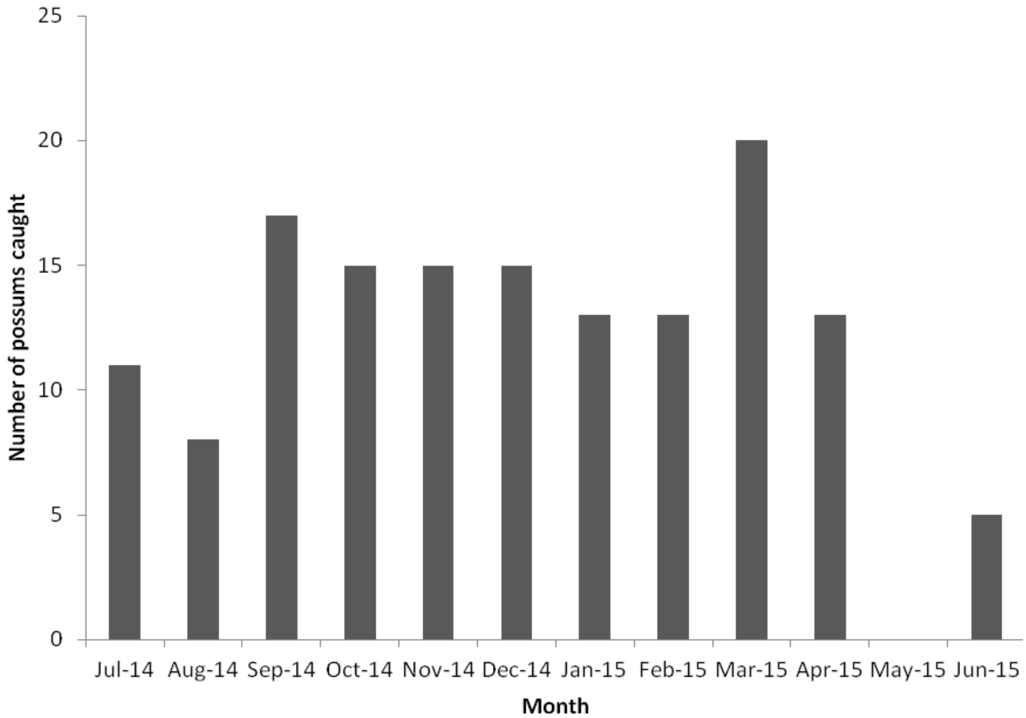


Figure 25. Possum captures on Friends of Rotoiti possum trap lines by month in 2014/15

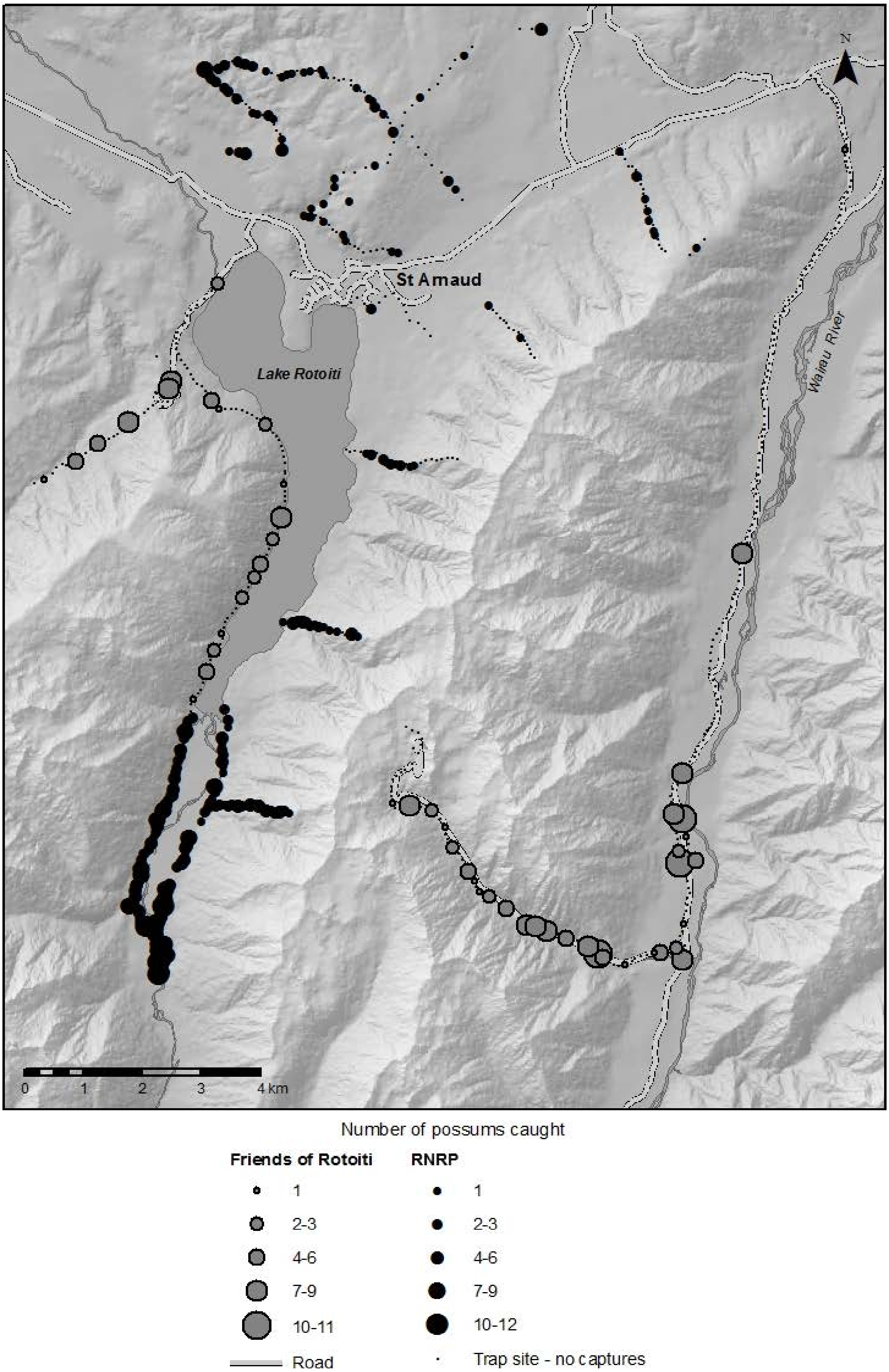


Figure 24. Locations of RNRP and Friends of Rotoiti possum catches in 2014/15.

2.1.6 Deer control and monitoring

Methods

A system was established to allow principally NZ Deerstalkers' Association local branch members access to the Mainland Island on a volunteer basis. This allows hunters to book access to hunting blocks within the RNRP.

The BFOB aerial 1080 operation in December 2014 may have contributed towards controlling deer within the Travers Valley and East Sabine catchments (see *section 2.1.2 Rotoiti Battle For Our Birds operation* for more detail on the operation), as deer are known to have been killed by ingesting 1080 pellets in the past (Fairweather et al. 2015). However 6g, not 12g baits, were used which is thought to limit the likelihood of deer ingesting a lethal dose of 1080.

Results

Deer and sign continue to be seen throughout the RNRP by DOC staff and volunteers occasionally while working, but interest in the RNRP hunting blocks from the public has been very limited, possibly due to the low numbers of deer thought to be present.

No hunting was allowed over a large portion of the RNRP between the 3rd of December 2014 and the 3rd September 2015 due to a caution period being in place following the BFOB aerial 1080 operation.

Live deer and fresh deer sign have been seen since the BFOB aerial 1080 operation in both the Travers and East Sabine catchments so the operation did not exterminate the entire deer population in the area.

There were no known recreational or professional hunting days in the RNRP during 2014/15.

Discussion

Although numbers of ungulates within the RNRP appear to be low or have a very patchy distribution, they are likely to have a negative effect on preferred species of native plants, such as *Pittosporum patulum*. Therefore, the number of browsers in the Mainland Island needs to be kept very low to reduce the impact on rare plant species in particular.

The RNRP hunting block system has not been particularly effective in encouraging members of the public to hunt within the Mainland Island, so ground-based deer control has been largely carried out by interested local DOC staff. This system needs to be re-visited, to ensure that it is compatible with current Health and Safety requirements, and to publicise it in an effort to increase deer control effort in the RNRP.

2.1.7 Pig control and monitoring

Introduction

Regular pig control is not carried out in the RNRP, despite pig rooting being repeatedly observed. Pig rooting is particularly noticeable along Dome Ridge in Big Bush and just below bushline on the northernmost tip of the St Arnaud Range, as well as occasionally being seen elsewhere within the Mainland Island.

Scavenging of possum carcasses from trap lines by pigs up the Travers Valley has been a problem in previous years. As well as using up funds replacing missing/damaged traps this also led to complaints from trampers that scavenged possum carcasses were being spread along the public walking tracks, creating a public health risk as well as an unpleasant visitor experience.

In response to the Travers Valley possum trapline scavenging, approximately eight hours of ground-based hunting with dogs was carried out in the 13/14 season. A lack of success led to the development of a remote-checked, live pig trap in January 2014. This was constructed close to a possum trap on the Lakehead trapline, at a site that was easily accessible by boat and a short walk to allow regular inspection.

Methods

The live pig trap had a VHF transmitter system with a mercury switch attached to the gate. When the gate was open, the signal would transmit continuously, meaning that the trap was baited and ready. When the signal stopped, the trap had been set off, or the transmitter had need of maintenance, either way indicating the trap needed checking.
With this system it was easy to check the trap's status from Kerr Bay using a Yagi antenna and TR4.

Considering the target pig was known to be attracted by dead possums, whenever the Travers Valley trap lines were checked (every three to four weeks) any fresh possums recovered from traps were added to the pig trap as bait.

Results

One boar was caught in the trap in August 2014, and was shot. The trap was then wired open and it has been observed that scavenging of possum carcasses in the Travers Valley has since ceased.

Discussion

Regular pig control would be beneficial to the RNRP. It is not known how much damage has been caused to snail colonies in areas of the St Arnaud Range where pigs are known to be present. Given the limited resources available at present, pig control has not been as high a priority as control of other predators such as stoats, rats and possums, as these are considered to be a more pressing threat to the ecosystem. However, if resources were to increase then this should be reconsidered, as pig rooting activity causes significant disturbance to the forest floor.

The remote-monitored pig trap system could potentially be a low cost way of capturing known problem pigs. A design has been found for a more portable trap system that could extend the possible trapping range further away from the lake edge and roads. The VHF remote-monitoring system proved to be quite effective once initial set-up teething problems had been fixed, and shows promise for reducing the effort required to check live-capture traps. Fermented barley has been identified as a likely more effective bait than possum carcasses, this should be looked into as an option for any future live-trapping or poisoning of pigs in the RNRP.

2.1.8 Kākā (*Nestor meridionalis*) monitoring

Introduction

South Island kākā (*Nestor meridionalis meridionalis*) have been a key focus since the beginning of the RNRP, with considerable effort having been put into radio-tracking kākā and monitoring nesting success in response to mustelid control in the past. This research found that mustelid trapping provided protection to the local kākā population, and that keeping mustelid tracking indices below 5% saw improved kākā breeding success (Moorhouse et al. 2003).

Intensive kākā research in the RNRP ceased after 2005/06, with low-effort encounter-rate monitoring taking its place as a means of observing long-term changes in the population.

Methods

Kākā encounter survey

The annual kākā encounter survey was conducted from the beginning of October 2014 to the end of April 2015. The surveys are carried out concurrently with mustelid trap checks along the below-bushline sections of nineteen trap lines that traverse suitable kākā habitat.

Trapping staff record the date, start and finish time, number of kākā encountered, closest trap box location, time of each kākā encounter and whether the birds were seen or heard.

Nest monitoring

This season rangers continued to relocate old known nest sites within the Mainland Island to allow future nest monitoring to determine the success of any kākā breeding activity.

Results

Kākā encounter survey

In 2014/15, forty-eight kākā were seen or heard over 247 hours, giving an encounter rate of 0.19 encounters per hour (see figure 26 and table 10). No kākā were encountered on the Angler's Walk trap line as in previous seasons, and this season none were encountered along the German Village, Struth or Teetotal Road trap lines either.

Table 10. Kākā encounter rates on RNRP trap lines over October 2014 - April 2015.

Trapline	Hours Surveyed	Number of kākā		Encounter rate per hour
		Seen	Heard	(Seen and heard)
Angler's Walk	8.4	0	0	0.00
Borlase Boundary	13.1	1	0	0.08
Black Sheep Gully	21.5	0	1	0.05
Black Valley Stream	18.4	2	3	0.27
Cedar	9.8	3	4	0.71
Clearwater	7.2	2	2	0.56
Dogleg	11.7	1	1	0.17
Dome Ridge	24	3	0	0.13
Duckpond Stream	9.3	1	1	0.22
Grunt	8.6	1	6	0.81
German Village	6.3	0	0	0.00
Hubcap	10.4	1	1	0.19
Lake Edge	29.8	0	2	0.07
Lakehead	6.7	0	1	0.15
MOR	13.5	0	3	0.22
Peninsula	16	2	2	0.25
Snail	16.4	1	3	0.24
Struth	8	0	0	0.00
Teetotal Road	8	0	0	0.00
Total	247	18	30	0.19

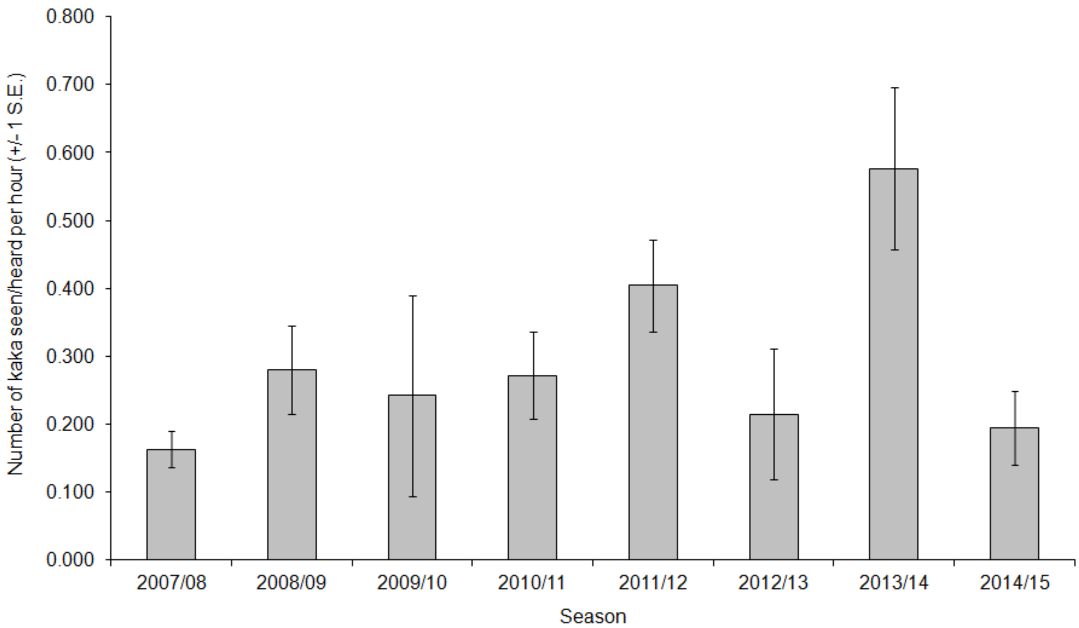


Figure 27. Mean (± 1 SE) kākā encounter rates (number of birds seen/heard per hour) in the RNRP from 2007/08 to 2014/15.

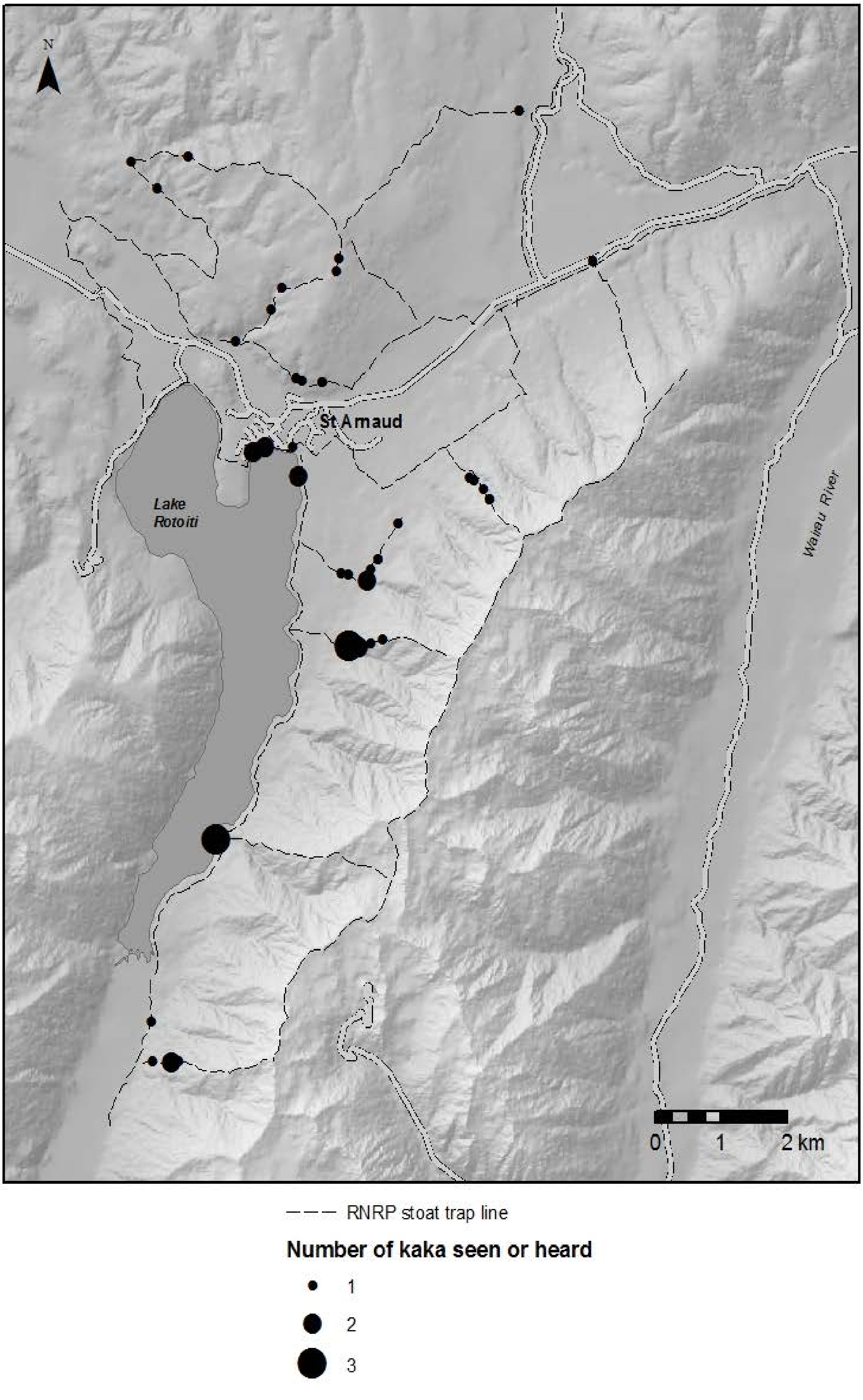


Figure 26. Locations of kākā encounters on RNRP trap lines (October 2014-April 2015).

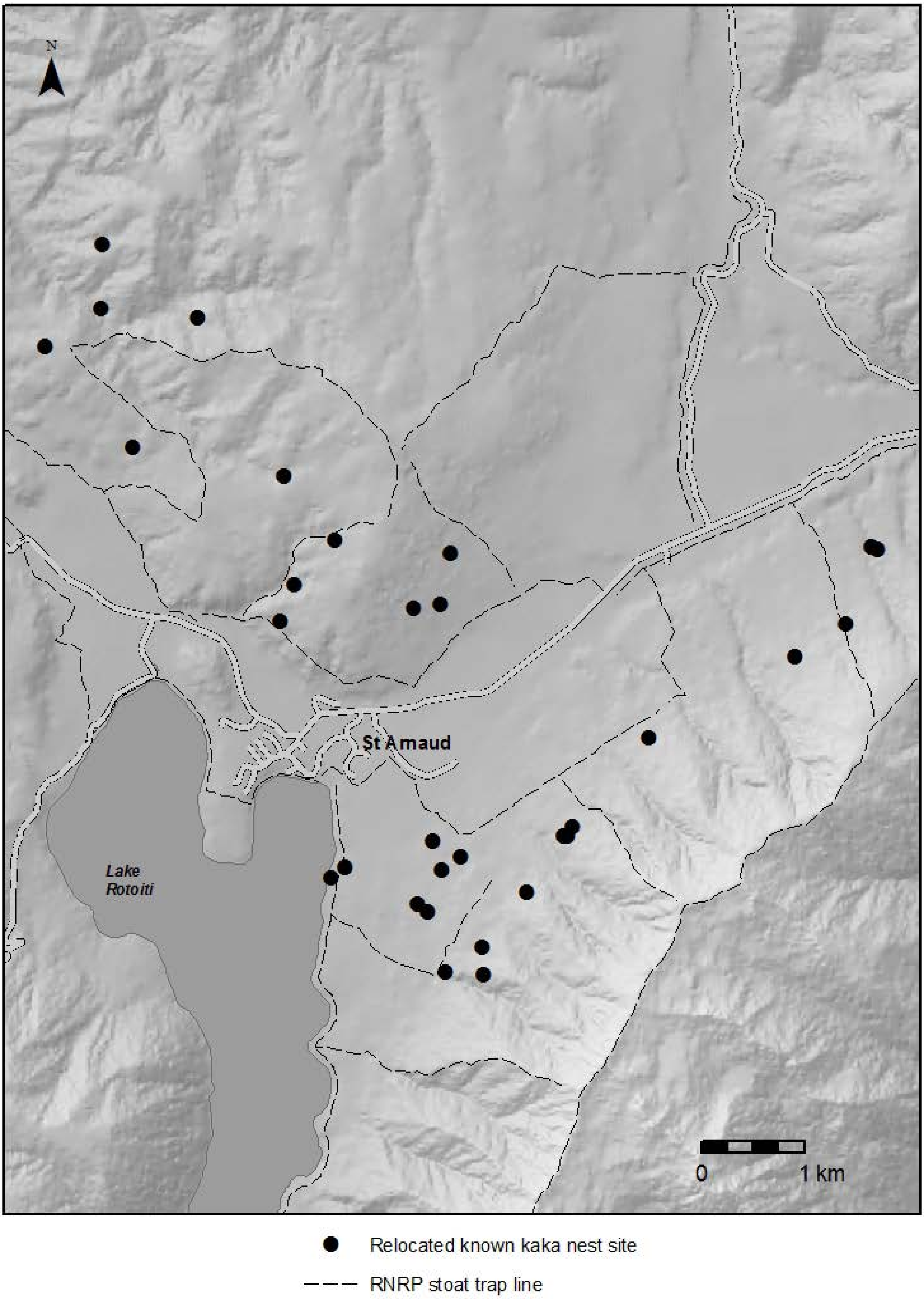


Figure 28. RNRP kākā nest sites known from research done in the 1990s that have been re-located in 2014/15.

Nest monitoring

No planned RNRP kākā nest monitoring occurred this year, however thirty old nest sites known from kākā research done in the 1990s have been relocated (see figure 28), within the intention of doing nest monitoring in future years.

Discussion

The encounter rate in 2014/15 was considerably lower than in 2013/14 but similar to most other years. The previous season's high encounter rate was likely caused by abundant beech flowering stimulating kākā breeding activity rather than by an actual increase in population. Small-scale monitoring found that some kākā breeding had occurred in a few nests within the RNRP, but there was no sign of successful fledging from any of these nests. However, a pair of kākā were observed feeding two fledglings on the St Arnaud Range track (J. Waite (DOC), *pers. obs.*), indicating that at least some successful breeding occurred.

The signs of mustelid predation found during last season's nest monitoring are of great concern, in particular the adult female found dead in a nest cavity, as predation of adult females is the type of mortality that does the most harm to kākā populations (Moorhouse et al. 2003). As discussed in the 2013/14 annual report the mustelid control regime during the second year of the self-resetting trap trial was not able to control the mustelid population to the required degree to provide protection to the kākā population and the pre-existing DOC-series trap network has now been reinstated. The BFOB aerial 1080 operation would likely have benefited kākā by removing stoats through secondary poisoning, however unfortunately the operation took place much later in the season than would have been ideal for protecting vulnerable female kākā while nesting (see *section 2.1.2 Rotoiti Battle For Our Birds operation* for more details).

The relocation of thirty old known nest sites will allow for more intensive monitoring of kākā nesting activity in the RNRP during future breeding years to provide better information on the status of the population. This will complement the encounter rate monitoring, which is a low-effort coarse measure of the population, amid concerns that the increasing use of volunteers to do stoat trap checks could be influencing the reliability of encounter rate monitoring results, as many volunteers are not particularly familiar with kākā so may not recognise their calls.

Volunteers could potentially carry out the bulk of the initial nest monitoring, freeing up DOC staff time and providing regular volunteers with a project that does not revolve around trapping.

2.1.9 Kea (*Nestor notabilis*) nest protection

Introduction

Kea are present in low numbers in Nelson Lakes National Park and there is evidence of a continuing slow decline (Steffens & Gasson 2009). Kea surveys and monitoring carried out by the Kea Conservation Trust (KCT) in the Lake Rotoiti/Raglan Range area over recent years provide evidence supporting a decline (J. Kemp (DOC) *pers. comm.,* in Harper et al. 2011), and suggest that possums and stoats kill kea nestlings and incubating adults fairly often. There is also evidence that lead roofing nails and flashings on buildings in the alpine zone (e.g. huts and ski field buildings) have caused lead poisoning in kea (C. Mosen (KCT) *pers. comm.*).

In light of an apparently declining kea population in the Nelson Lakes area and the fact that one of the principal agents of decline is likely to be predation at nests, in 2011/12 the RNRP embarked on a partnership with the KCT to set up nest protection in the form of stoat and possum traps around known active nests on the St Arnaud and Raglan ranges. The number of kea nests protected and the extent of protection provided to each nest has increased each year since then, with new trap networks installed around two further nest sites this year.

In 2014/15, the BFOB aerial 1080 operation treatment area only covered one known active kea nest, which was within the area previously receiving landscape-scale ground-based mustelid control via trapping. The BFOB operation therefore did not influence the kea nest protection programme which continued as it had in previous years. See *section 2.1.2.7 BFOB kea diversion project* for more detail on attempts to mitigate the threat to kea from the aerial 1080 operation.

Methods

Because the kea nest trap networks were set up in different years and have expanded slowly over time, in addition to the difficult terrain making tidy grid patterns unfeasible, there is a lot of variation between them. In 2014/15 the trap networks were as seen in figure 29, details on trap types and numbers as follows:

Nest 5: 14 Sentinel possum traps covering approximately 300×300m (9ha) around the nest, 1 DOC200 stoat trap ~20m from nest entrance. An existing Friends of Rotoiti trapline of DOC200 traps along the ski field road passes within 200m of the nest.

Nest 8: 9 Sentinel possum traps covering approximately 150×300m (4.5ha) around the nest, 2 DOC200 stoat traps ~20m from nest entrance. An existing Friends of Rotoiti trapline of DOC200 traps along the ski field road passes within 200m of the nest.

Nest 9: 6 Sentinel possum traps and 6 DOC200 stoat traps in a straight line up the ridge where nest is located. This trapline was installed this year, the intention is to expand it in the future.

Nest 27: 11 Sentinel possum traps and 8 DOC200 stoat traps in a 400×200m grid around the nest (8ha). This trapline was installed this year following the discovery of a new nest site. An existing Friends of Rotoiti trapline of DOC200 and Sentinel traps along the Speargrass Track passes within 150m of the nest.

Raglan northern nest sites: 21 Sentinel possum traps in a 700×200m grid around the 3 nest sites (14ha), and 24 DOC200 stoat traps in two lines of 12 going straight up the ridges either side of the nest sites.

Raglan southern nest site: 9 Sentinel possum traps in a 200×200m grid around the nest (4ha), and 12 DOC200 stoat traps (3 of these are double-set) in a line up a creek and then ridge leading to the nest site.

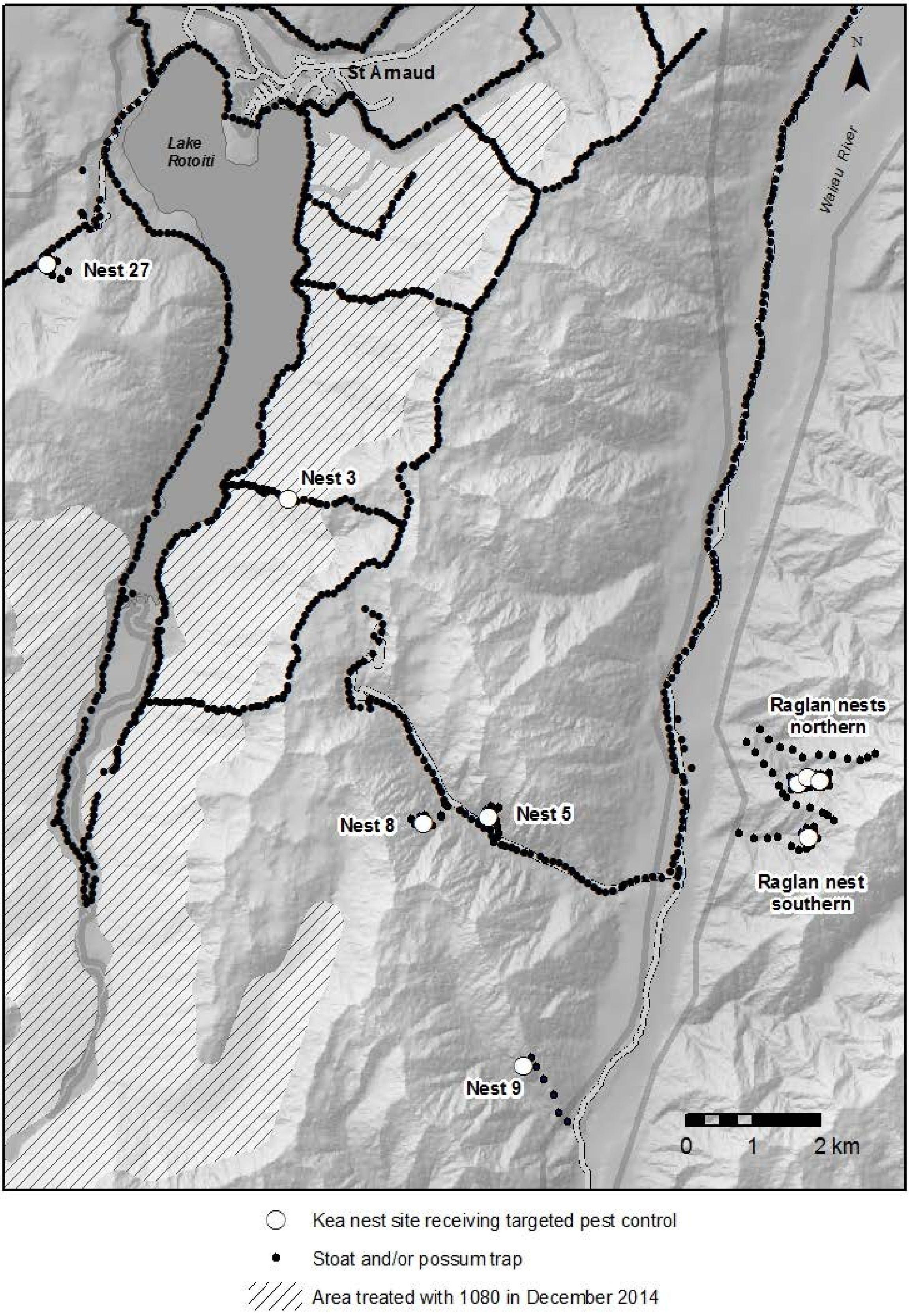


Figure 29. Location of RNRP kea nests receiving targeted pest control, 2014/15.

In order to provide protection from pests from the very start of the breeding season, initially all kea nest protection trap networks were opened, baited and serviced monthly, beginning in July 2014. As monitoring of radio-tagged kea and nest sites by Corey Mosen (KCT) provided more information on which kea were nesting and where, it became apparent that only the Raglan northern nest site and the nest within the BFOB treatment area were being used by kea this year, so all other trap networks ceased to be serviced after September.

All traps were closed in December/January to protect juvenile kea from being caught in the traps since they are considered more likely to investigate the traps than the breeding adults.

Results

Many predators were caught by the kea nest trap networks (see table 11).

Table 11. Number of captures and sprung traps on RNRP kea nest trap lines in 2014/15.

	Trap catch					
Kea nest	Stoat	Weasel	Possum	Rat	Mouse	Sprung
Nest 27	0	0	42	16	0	13
Nest 8	2	0	5	0	0	1
Nest 9	2	0	5	1	0	3
Raglan(north)	1	1	44	6	2	8
Raglan(south)	1	0	15	10	2	3
Total	6	1	111	33	4	28

The kea nesting at the northern Raglan nest site successfully fledged three juveniles.

The kea nesting within the BFOB treatment site had their first nest fail due to predation prior to the BFOB operation taking place. Their second nesting attempt successfully fledged three juveniles after the BFOB operation, despite the female of the pair being killed from poisoning after ingesting 1080 pellets, as the male of the pair was observed to keep feeding the chicks after the loss of his partner.

Discussion

In 2014/15 both the recommendations from the previous year concerning kea nest protection were implemented: more known nest sites were protected, and trap networks were opened in July, earlier than they had been in the past.

The collaboration between DOC and the KCT works well, with monitoring carried out by Corey Mosen informing decisions around the amount of effort put into servicing traps by DOC staff, assisting DOC to most efficiently use limited resources.

Lead still remains present in the Nelson Lakes area in the form of nails, flashing and the like on older huts/bivs. Lead is such a major threat to kea (C. Mosen, *pers. comm.*) that more effort should be put into removing lead from the huts and ski field buildings where it remains. No work was carried out to address this threat in 2014/15.

2.1.10 Weka monitoring

While weka were intensively monitored in the RNRP over 2010-2012, weka monitoring since then has been limited to ad-hoc banding of weka caught around the St Arnaud village, and recording observations.

Due to limited resources and the fact that weka are not considered a high priority species for management in this area, the banding of local weka has now ceased, as the practice can cause stress/injury to individual birds which is difficult to justify unless band data is being used for research which should ultimately benefit the species.

Weka sightings are still recorded in order to provide coarse data on changes in weka numbers in the area that may be of use in the future (see Appendix 1 for a link to this database).

2.1.11 Mistletoe monitoring

No mistletoe monitoring was scheduled to be undertaken this season. The next re-measure will be done during the 2016/17 season.

2.1.12 *Pittosporum patulum* monitoring

No *Pittosporum patulum* monitoring was scheduled to be undertaken this season, however due to the implementation of the BFOB aerial 1080 operation *P. patulum* FBI monitoring was started in January 2015, with the intention of capturing any changes that might result from the operation.

Time constraints meant that not all individual plants could be visited and no further visits were made. The data was entered into a database (see Appendix 1) but has not been analysed. Full monitoring is next due four years after the last full measure, hence will take place in November 2017.

2.1.13 *Powelliphanta* sp. Monitoring

Introduction

There are three distinct populations of alpine *Powelliphanta* snails in the Nelson Lakes area, however they have not yet been studied in enough detail to identify whether or not they are separate taxonomic units so they are currently known collectively as *Powelliphanta* "Nelson Lakes" (Walker, 2003). One of these populations is on the edge of the RNRP area, around bush-line on Snail spur.

The major threats to these snails have been habitat loss and habitat degradation. While further habitat loss is not currently a threat since these populations inhabit conservation land, habitat degradation from grazing of the alpine plant communities by ungulates and hares and rooting activity of pigs, as well as direct predation by exotic birds, rodents and pigs, remain as pressures.

Permanent snail monitoring plots were established in 1997 and 1999 to be measured at five-yearly intervals to measure population trends, with the RNRP population theoretically benefiting from a reduction in deer, possum and rodent numbers due to pest control within the RNRP (Walker, 2003).

Whether or not the RNRP snail colony has been afforded any protection from historic RNRP pest control is uncertain. Rodent and possum control have not been carried out above bush-line to date, deer/pig control has been sporadic at best and no effort has been put into controlling hares.

In 2014/15 the BFOB aerial 1080 operation was initially planned to include the area where the snail colony is present within the treatment boundary, however at short notice the treatment area was altered to not include any alpine areas, due to concerns over risks to rock wren. Rock wren are no longer believed to occupy the alpine areas of the St Arnaud range so were unlikely to be at risk from the Rotoiti operation, however DOC took a precautionary approach and applied this directive to all aerial 1080 operations being carried out in late 2014. Therefore, ultimately the Rotoiti BFOB operation did not provide as much protection from rat and possum predation to the snail colony as was intended.

Methods

The RNRP snail plots consist of three 10×10m plots, each made up of four 5×5m quadrats, on Snail spur near bushline. One plot is located within the forest, one on the forest edge and the third within the open tussock.

The standard technique for carrying out *Powelliphanta* monitoring was used, as per Walker (1993).

Results

In total thirteen live snails and nine empty shells were found during the 2014/15 survey. All but one of the live snails were found in the open tussock plot, with no live snails at all and only one empty shell found in the within-forest plot.

Of the empty shells, two were confirmed as having been recently (within previous few months) preyed on by rats, the cause of death of the rest was unknown. Hare faecal pellets and a dead mouse were found in the plots, but no possum pellets.

Discussion

The small number of live snails and empty shells in the RNRP plots suggest that the monitored population is small and still declining (K. Walker (DOC), *pers. comm.*). While the BFOB aerial 1080 operation this year could have provided some protection from the ongoing rat and possum predation that the snails are likely to be experiencing, due to changes to the treatment boundaries this was not the case and this snail population and its habitat continues to be mostly unprotected by RNRP pest control efforts. As long as this remains the case, then the RNRP snail monitoring is not genuinely outcome monitoring, because little to no pest control is being done that might have an outcome to monitor.

One of the reasons why the RNRP site was selected as a Mainland Island in the first place was because of the possibility at this site of research into how to protect species in the alpine zone (K. Walker (DOC), *pers. comm.*), however so far this aspect of the project has been largely neglected. In addition to the lack of pest control in the surrounding area, there are concerns that the very act of monitoring the population every five years is overly degrading the habitat.

Several actions are being considered to address these concerns. Firstly, a recommendation has been made that if another aerial 1080 operation is carried out at Rotoiti then a case should be made for including the alpine zone in certain areas, given the low likelihood of any rock wren being present.

Secondly, local DOC staff are intending to erect a fence that will exclude hares and ungulates around an area where these snails are known to be present. The plan at the time of writing is to make this exclosure plot large enough to encompass a 20×20m vegetation monitoring plot. Long-term monitoring results from this should provide information on the impacts of these browsers on the alpine habitat.

Finally, sporadic sightings of snail shells further north along the St Arnaud Range indicate that another snail colony is present there. This colony could be located and monitored in order to compare the results with those from the colony that has been regularly monitored for many years. Since this new colony will have suffered similar levels of predation and habitat disruption from exotic species, but not habitat disturbance from monitoring, the results should provide some insight into what level of impact the five-yearly monitoring is having.

2.2 Establish and maintain populations of whio (*Hymenolaimus malacorhynchos*), great spotted kiwi (*Apteryx haastii*), rock wren (*Xenicus gilviventris*) and other native species

2.2.1 Introduction

At the time of writing, only great spotted kiwi have been reintroduced to the RNRP, however similar reestablishments of whio, rock wren, and other native species known to once have been present in the area remain as goals for the future.

2.2.2 Great spotted kiwi population management

Introduction

Great spotted kiwi (GSK), the largest kiwi species found in New Zealand, were likely present in the Nelson Lakes area early in the 20th century, but have since become locally extinct (Steffens & Gasson 2009). Sixteen GSK sourced from a population at the Gouland Downs, Kahurangi National Park, were reintroduced to the Mainland Island via two translocations in 2004 and 2006. The reintroduced birds settled well and have since produced at least eight chicks.

Breeding activity has not been as high as expected and a proposal to supplement the population with up to fourteen operation Nest Egg (ONE) chicks, sourced as eggs from the Gouland Downs, was approved in 2008. The operation commenced in early 2009 with the radio-tagging of adults at the Gouland Downs followed by three seasons of egg-lifting, with the final eggs lifted in December 2011.

Additional ONE chicks have been translocated to the RNRP from the Stockton mine area under an agreement relating to the expansion of mining operations at Cypress mine.

Methods

ONE translocations took place during the 2014/15 season. Eggs were removed from monitored pairs on the Stockton Plateau and reared at the Paparoa Wildlife Trust crèche before being translocated to the RNRP once they had reached a healthy weight. All chicks were placed into artificial burrows within a holding pen (approximately 200m^2) and released after one night, due to their age, substantial weight and good condition. Previously chicks have been released after approximately one week.

Monitoring of both ONE and wild chicks continues wherever possible. Birds are weighed and checked regularly within their first year, and any mortality signals from transmitters are investigated promptly.

Ongoing predator control in the RNRP is thought to have benefitted kiwi, principally through the control of stoats and cats, which can prey on kiwi chicks. See *sections 2.1.2 Rotoiti Battle For Our Birds operation, 2.1.3 Non-BFOB mustelid control* and *2.1.4 Feral cat control* for more details on RNRP predator control.

Dogs remain one of the biggest threats to kiwi nationally. Signs at the main entrances to the National Park are maintained to remind people that dogs are prohibited. It is likely that one adult kiwi death in 2010 was caused by a dog (Harper et al. 2010). Publicity about the threat of dogs to kiwi is ongoing, and appears regularly in the local paper and at the Visitor Centre.

Results

Two kiwi from the Stockton ONE program were placed into an artificial burrow inside the release pen at mid-day on the 1st April 2015. The pen was opened the next morning. It was thought that as these birds were older and heavier than previous ONE releases, they would not need the full week that other birds had been given in the pen. Both birds were of an unknown sex, and had similar weights of about 1600g. They were fitted with transmitters, and post-release weigh-ins were planned for a one-week and a one-month interval to monitor dispersal and watch for any weight loss. A three month weigh-in is planned for late July/early August 2015.

Totoweka, initial weight 1600g, had no loss of weight at all. A weight increase of 200g was observed in Totoweka a month after release into the Mainland Island. This bird was known to be more reserved than its release mate, and on both checks it was found no more than 350m from the release site, though had moved upwards about 80m in altitude. This is understandable as the release area is known to be a very productive area, and is already home to two adult pairs of kiwi.

Kokopu, initial weight 1550g, also had no loss of weight at all. This bird also had an increase of 200g after only two weeks in the RNRP. Kokopu was known to favour crown fern as a roost and often ran from capture, and this behaviour persisted after release. At first this kiwi was found to have dispersed about 650m northwards, but most recently four months after the release date it was found back only around 100m from the soft-release pen.

2.2.3 Great spotted kiwi population monitoring

Methods

Remote monitoring of radio-tagged birds for mortality and breeding has continued. Every year the number of radio-tagged GSK fluctuates due to transmitters failing or dropping off, and through the re-location of individuals allowing new transmitters to be re-fitted.

Acoustic recorders have been used in the past to try to locate missing kiwi within the RNRP, and have been used to follow up on reports from the public in other areas. Kiwi Call Counts, a national community-based monitoring scheme, did once again not take place this year. This scheme is planned to be used in the future, along with kiwi round-ups using trained kiwi dogs to provide an index of the population’s size and age distribution.

Results

Breeding results

Breeding activity was observed in Motupipi (male) and likely partner Waitapu (female, not transmittered). In early October, Motupipi’s “egg timer” transmitter switched into incubation mode, indicating that he was on a nest. Staff investigated this using triangulation and close fixes to determine his position. It was decided that he was indeed on a nest, and he was monitored closely for the following month. The nest was located in an old stump in the middle of a large windfall, so it was not possible to place trail cameras on the nest entrances without making a large amount of noise.

Two trail cameras were set up on what appeared to be trails in and out of the windfall, resulting in some footage of kiwi coming and going. Over time it was established that Motupipi had changed position and was therefore no longer on this nest. The nest is thought to have been abandoned sometime between 18th and 20th December. It was never established what caused the failure of this nesting attempt, as camera footage did not provide any useful information. In early June, Motupipi was found sharing a burrow with his long-term mate Waitapu, who weighed a substantial 4,300g. No chick was sighted. Of note is the 4,300g weight which is thought to be at the upper weight limit of GSK, and could potentially indicate that this pair occupies one of the most favourable territories in terms of food production.

No other breeding attempts were detected.

Acoustic Recorders

Bird song recorders were placed at Louis Creek in the Howard Valley, following a report of kiwi calls being heard nightly by a gold panner. Six recorders over three ridges, effectively covering the entire Louis Creek area, were deployed for thirteen-hour periods over ten nights. Two of the recorders malfunctioned and due to recorder card storage limitations, only eight nights were recorded. However, the recorders were placed close enough to allow for any problems like this, and it is not thought that this would have caused any blind spots. No kiwi calls were detected in the resulting recordings.

3. Learning objectives

3.1 Test the effectiveness of control methods for stoats, rats, cats, possums, wasps and other potential pest species in a beech forest and alpine ecosystem

3.1.1 Test the effectiveness of wasp control tools

Introduction

Common wasps (*Vespula vulgaris*) are a major threat to biodiversity within the RNRP due to them reaching extremely high densities within the honeydew beech forest (Thomas et al. 1990). They have three known impacts on honeydew beech forest biodiversity (points 1 to 3) and at least two potential impacts (points 4 and 5):

1. Taking of honeydew. This reduces its availability as a food for native birds (e.g. kākā and tui), invertebrates (Harris, 1991) and herpetofauna (Evans et al. 2015).
2. Predation of invertebrates (Harris, 1991)
3. Killing of bird nestlings (Moller, 1990)
4. Competition with other detritivores due to removal of animal carcasses
5. Impacts on the scale insect that produces honeydew, suggested as a possibility due to field observations of damaged scale insect filaments by DOC Nelson Lakes staff

Wasps also severely affect the activities of people using the area in summer, putting DOC staff and volunteers at risk of going into anaphylactic shock after being stung while working within the RNRP, and negatively influencing the experience of public visitors to the area.

Wasps have been controlled in the Core Area of the Mainland Island since 1998, using various protein-based baits that mainly contain the toxins Finitron® or fipronil. This work was originally carried out in close association with Landcare Research and more recently with the Nelson-based company Entecol, which is currently the only supplier of the toxic bait X-stinguish™ (0.1% fipronil).

Fipronil has proven to be the more effective of the two toxins and since the 2007/08 season, only X-stinguish™ has been used for wasp control operations in the RNRP. However, access to this toxic bait has until 2015 been constrained by commercial imperatives, with DOC Nelson Lakes only able to use it under an experimental use arrangement. In 2015 a DOC pilot trial of using X-stinguish™ for landscape-scale wasp control was completed successfully at five sites, one being the RNRP. This was a key step towards an agreement between DOC and BASF (the company that produces fipronil) which would see the commercial restrictions on fipronil use lifted, making it more widely available for wasp control in New Zealand.

The most recent RNRP research has focussed on determining the widest possible spacing between wasp bait lines whilst still achieving the desired reduction in wasp densities, as well as getting a better understanding of the quantity of bait necessary per bait station.

Over recent years it has appeared that some unknown factor may be reducing wasp numbers, possibly by affecting nest establishment by queens or the health of workers. Landcare Research is researching a mite that was recently discovered on common wasp queens and whether it holds any potential for use as a biocontrol agent. The RNRP has been supporting this investigation by collecting queen wasps hosting the mites, to pass on to researchers.

Methods: control

In 2014/15 the wasp control treatment area was extended significantly along the eastern side of Lake Rotoiti, now covering ~1129ha of the RNRP as well as ~150ha of Tasman District Council road reserve around the St Arnaud village which adjoins the RNRP (see figure 30).

The same two bait station arrays as in 2013/14 were used in the Core Area this year, one with single bait stations on a 300×50m grid following the contours, the other with single bait stations on a 400×50m grid. In Big Bush, the existing 400×50m grid perpendicular to the contours was used. The new extension down Lake Rotoiti used a 300×50m grid following the contours.

The existing bait station arrays used orange KK bait stations, whereas the new extension used yellow Wasptek bait stations which are designed specifically to dispense wasp bait.

To ensure that the poison operation will be effective, wasp visitation on non-toxic protein-based baits is monitored prior to an operation. An average of one wasp per bait is considered the trigger point for initiating the decision-making process to start a poison operation. For further details on wasp monitoring and the decision-making process, refer to the *RNRP Field Manual* (DOC-431791).

20g of X-stinguish™ bait was applied to each bait station in early February once the protein-take trigger point was reached. Any remaining bait was collected three to five days later and weighed to determine the amount of bait take.

Methods: monitoring

Result monitoring for wasp control was carried out in two ways. Wasp nest flight counts were recorded for ten nests along transects in each treatment area, and a wasp foraging index was calculated by counting the number of wasps on non-toxic protein baits after approximately one hour.

Outcome monitoring for wasp control was done by recording the number of honeydew droplets within permanently-marked 5×50cm plots on marked trees.

All three monitoring methods were carried out before and after the operation in both treatment areas (300×50m bait station grid and 400×50m grid) and non-treatment areas (Hubcap on St Arnaud Range north of bait station grid, and Big Bush northwest of bait station grid, see figure 30). For more detail on monitoring methods, see the *Honeydew monitoring protocol* (DOC-1536769) and *Wasp abundance monitoring protocol* (DOC-691729).

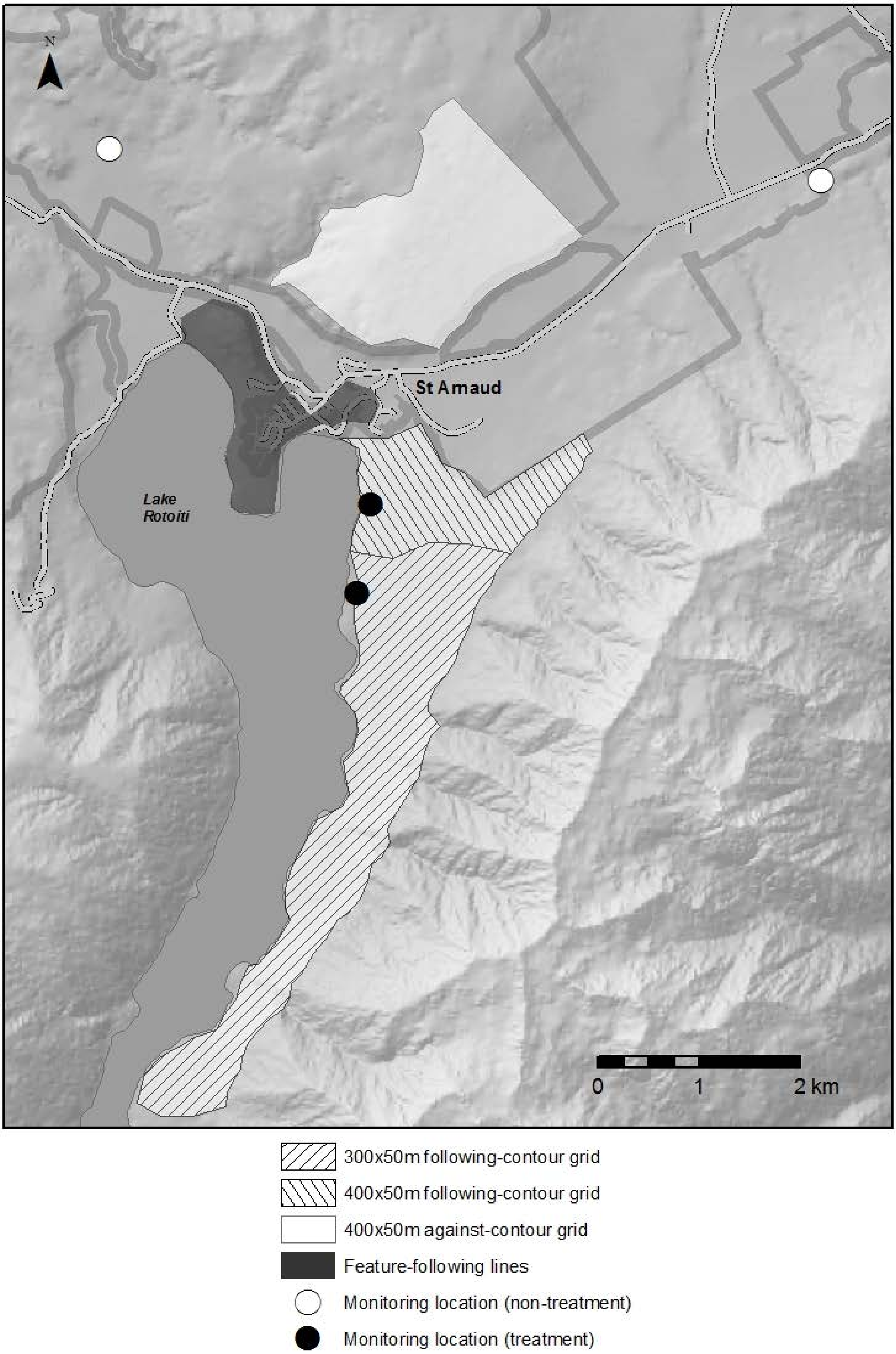


Figure 30. Location of RNRP wasp control bait station grids/lines in 2014/15.

Results

On 27th January 2014 (i.e. prior to the operation), an average of 12.5 wasps were observed on non-toxic baits. This was far above the one wasp per bait threshold, so the poison operation was initiated.

In total, 28.1 kg of toxic bait was deployed this season and 25 kg (89%) of this was removed by wasps. Bait take was highest in the new Lakeside extension (96%), followed by the Core Area (91%) and the St Arnaud village (87%) with bait take lowest in Big Bush (82%).

Between the 22nd of January (~two weeks prior to the wasp control operation) and the final monitoring period on the 20th of March (~five weeks after the operation), the operation achieved a 100% decrease to zero in the average number of wasp flight counts at monitored nests in the 300×50m grid, and a 97% decrease in flight counts within the 400×50m grid. Over the same period, an 81% increase in flight counts was observed at the untreated Hubcap site, and a 39% increase at Big Bush (see figure 31).

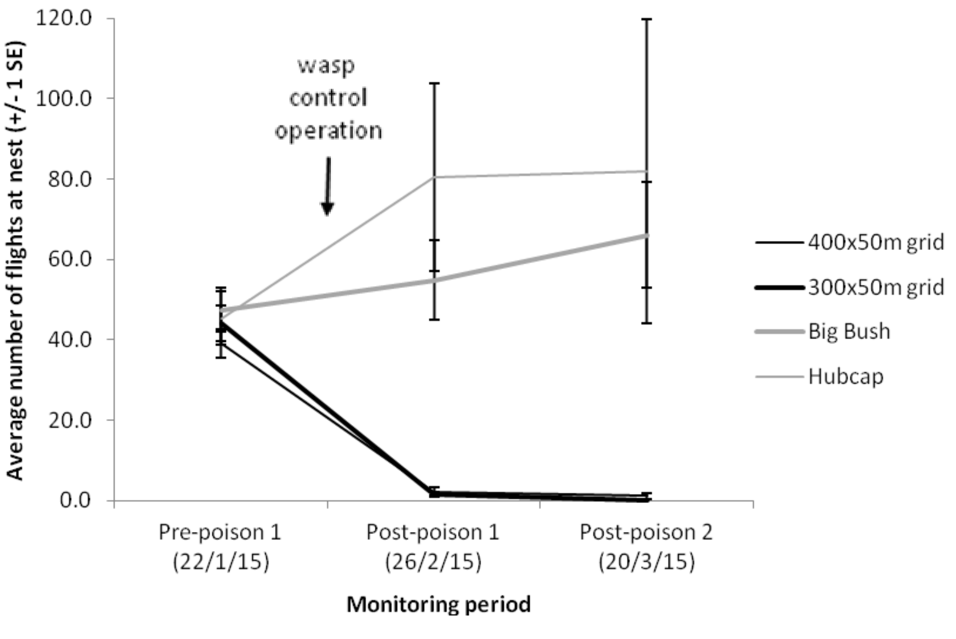


Figure 31. Changes in average number of flights in or out of monitored wasp nests in wasp control treatment (400×50m and 300×50m grids) and non-treatment areas (Big Bush and Hubcap) in the RNRP, 2015.

The honeydew monitoring results are not quite as straightforward, with all monitored sites experiencing a decrease in average number of honeydew droplets within plots between the first two pre-operation monitoring periods, followed by an increase in honeydew between the second pre-operation monitor and the first post-operation monitor (see figure 32). However, between the pre-poison monitor and second post-poison monitor, within the treatment areas honeydew droplets increased by 409% and 396% respectively in the 400×50m and 300×50m grids, whereas in the untreated areas number of droplets decreased overall by 4% at Hubcap but increased by 210% at Big Bush. While the latter shows an increase in honeydew outside a treated area, it is less of an increase than that observed within the treated areas.

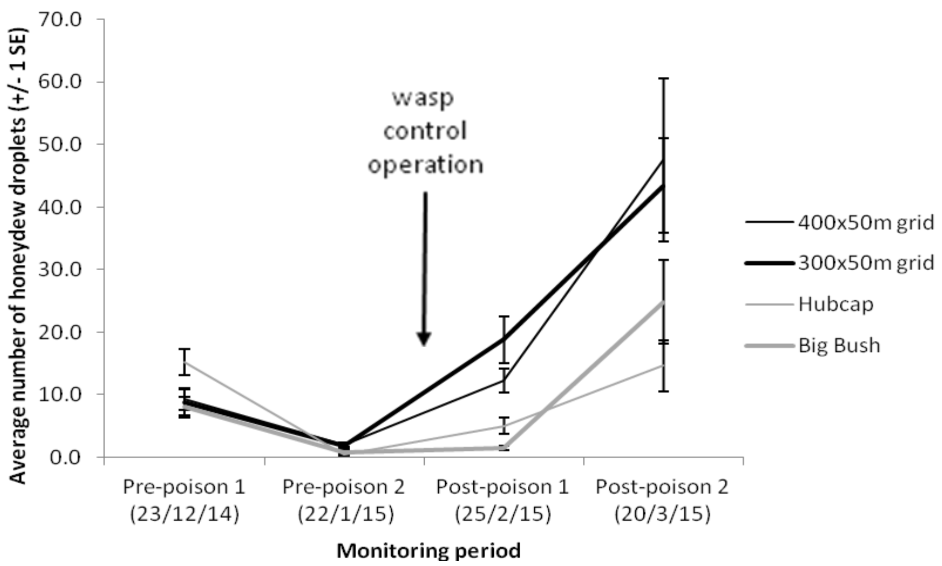


Figure 32. Changes in average number of honeydew droplets within monitored plots in wasp control treatment (400×50m and 300×50m grids) and non-treatment (Hubcap and Big Bush) areas in RNRP, 2015.

The toxic bait take by wasps this year was the highest it has been in the last five years, with nearly all bait taken from the Lakeside 300×50m grid extension (X, Y and Z blocks), which was the last block to be treated this year and has not been treated before.

Table 12. Percentage of wasp bait taken in different wasp bait station blocks in the RNRP from 2011 to 2015.

	Year				
Area	2015	2014	2013	2012	2011
RNRP Core	91%	65%	50%	18%	61%
St Arnaud village	87%	69%	50%	33%	70%
Big Bush	82%	76%	27%	19%	55%
Lakeside extension	96%	N/A	N/A	N/A	N/A
Total	89%	70%	42%	22%	61%

Discussion

The 2014/15 wasp control operation was initiated in February following the protein-interest threshold being reached in January. As in 2013/14, 20g of bait was put out per bait station. The high bait take this year indicates that reducing the amount of bait put out to less than 20g (as was suggested for consideration in the 2013/14 RNRP Annual Report) could have had a negative impact on the success of the operation. However, this bait take data is only coarse as it is calculated simply by weighing bait put out and bait pulled back in, which does not take into account any desiccation of the bait. It has been noticed by DOC staff that some years the bait pulled back in is almost dust-like in consistency, whereas in other years the bait has remained hydrated and therefore heavier.

The toxic operation was once again successful in reducing the wasp nuisance around St Arnaud village. Wasp activity within the Core Area was observed to decline within a few days of the operation, and this was also reflected in the reduced wasp flight counts and the increase in honeydew droplets recorded during planned monitoring. The monitoring in the Core Area indicated that the operation was successful in increasing the availability of honeydew to native birds; while honeydew droplet numbers did also increase in the untreated areas over the post-operation period, the treated areas showed a larger increase as can be seen in figure 32. This year, no long-term significant difference in results was observed between the 400×50m and 300×50m treated grids.

Landcare Research is still conducting an investigation into this mite and whether it holds any potential for use as a biocontrol agent. The RNRP continues to support this research by collecting queen wasps hosting the mites.

3.2 Maintain long-term datasets on bird abundance and forest health in response to ongoing management and predator population cycles

3.2.1 Five-minute bird counts

Methods

Five-minute bird counts (5MBC) were conducted using the technique detailed by Dawson and Bull (1975) on the St Arnaud Range Track in the Core Area, at Lakehead and along the Mt Misery Track at Rotoroa. Each site is meant to be sampled three times in November and February and May, however this was not possible due to constraints on staff time. In November only one count was done which was on the St Arnaud Range. In February seven counts were done, three at Rotoroa and two at each of Lakehead and St Arnaud Range, however five of these counts were done by the same person. In May seven counts were done with only one count done at Rotoroa. Four different observers were used this year.

Results

The raw bird count data has been entered into the RNRP 5MBC database (see Appendix 1), but no analysis has yet been carried out on it by RNRP staff.

Discussion

Competing requirements for limited staff resources meant that a full set of 5MBCs for the RNRP project was not able to be completed this year. Given this is a long term dataset, more priority should be given to getting all counts done in the future. Experienced university students are a potential untapped source of data gatherers.

There has been no local analysis of the raw 5MBC data to date. Given the time and effort that is required to collect and enter these data (approximately 27 person/days each year) and the fact that this is such a long-running dataset, analysis of the 5MBC data should be encouraged.

It is also important that the 5MBC data from the RNRP is added to the national 5MBC database, to add to what is an increasingly valuable dataset for big-picture analysis.

3.2.2 Vegetation Plot Monitoring

Twenty 20×20m vegetation plots were set up in 1997-1999. These are monitored regularly using the updated field protocols for permanent plots and the RECCE method (Hurst & Allen 2007a, 2007b).

Most plots were measured for the third time in 2012/13. No vegetation plot monitoring took place in 2014/15.

3.2.3 Tussock plot monitoring

Introduction

Tussocks in New Zealand, like the beech trees, are mast seeders. They are therefore an important driver of mouse population dynamics in the alpine zone, and consequently influence the populations of other pests who prey on mice such as weasels and stoats. Tussock monitoring had been historically carried out at Mt Misery and was reinstated in 2010 to continue this long-term dataset. In the future climate change and its influence on tussock masting might allow rats to regularly inhabit higher-altitude areas than they currently do, providing another rationale for regular tussock monitoring to be carried out.

Methods

The flowering of mib-ribbed snow tussock (*Chionochloa pallens*) and carpet grass (*C. australis*) was measured in March 2015.

Originally flowering stems were counted within an 'arm sweep' of the old Department of Scientific and Industrial Research (DSIR) points. Following advice on improvements to the methodology, a new method where flowering stems are counted within a permanently-marked 20×20m plot was initiated in 2012/13.

It was recommended by the Technical Advisory Group (TAG) that counts using both methods should be carried out for several years to allow a comparative analysis. 2014/15 is the fourth season in which both methods have been used.

Results

Tussock monitoring results are shown in table 13. Both methods found a mean number of flowering stems per m^2 not much above zero for both species, which is very low compared to e.g. a mean of 137.38 flowering stems per m^2 for *C. australis* in 2014.

Table 13. Number of flowering stems per m^2 of two tussock species on Mt Misery, Nelson Lakes National Park, March 2015

Species	Mean number flowering stems per m^2	
	Old DSIR method	New 20x20 method
Chionochloa pallens	0.14	0.1
C. australis	0.77	6

Discussion

The results suggest that 2015 will not be a mast year for tussocks in the Nelson Lakes National Park, so a mouse irruption in the alpine zone is unlikely to occur this following season.

After four years of carrying out both old and new monitoring methods we might have sufficient overlapping data to only use the new method for future tussock monitoring. This will be discussed with the RNRP TAG before a decision is made.

3.3 Record observations of previously unreported native and non-native species in the RNRP area

Introduction

The intention of the systematic recording of previously unreported native and non-native organisms is to maximise the learning from observations of species previously unknown to be present, regardless of whether or not these observations are part of an organised survey. Increased knowledge of the native species present in the Mainland Island is useful, and the detection of exotic and potentially invasive plants or animals will inform management actions to protect biodiversity values.

Results

The repository for new information is the document *Flora and fauna of Lake Rotoiti Recovery Project* (DOC-172620).

One new species was recorded in 2014/15; a mandarin duck (*Aix galericulata*) which was first observed by DOC staff in August 2014 and has become resident in the vicinity of St Arnaud, most frequently seen at Kerr Bay on Lake Rotoiti but also at West Bay and the duckpond in Teetotal.

Other sightings of less frequently seen species include:

- The male whio/blue duck (*Hymenolaimus malacorhynchos*) at Blue Lake in the Sabine headwater appears to have been joined by a female duck. A photo taken of four whio on the lake suggests that the pair might have produced two offspring. While this area is not within the RNRP's current boundaries, this is the closest known whio population to the RNRP, which if aided to breed successfully could potentially eventually recolonise the Travers river.

- Kārearea/Falcon (*Falco novaeseelandiae*) have been sighted intermittently in the RNRP, with a pair nesting and successfully fledging three chicks from a nest on Mt Robert.

- Mātātā/Fern birds (*Bowdleria punctata*) have twice been encountered this year in the RNRP, with two birds heard in Black Valley Swamp and one seen near trap TRF19 in Teetotal.

3.4 Facilitate research to improve our understanding of the ecology and management of beech forest, alpine and wetland ecosystems

The RNRP provides an accessible site with a long history of data collection for external researchers and the possibility of logistical support from DOC for carrying out fieldwork.

One student conducted research within the RNRP this year. Chris Niebuhr, a PhD student from the University of Otago, is investigating the role avian malaria may be playing in native bird declines in the area. Avian malaria is a mosquito-borne disease that does not affect humans, but has caused the death of native New Zealand birds in recent years. Chris completed his third and final field season over January-April 2015 and has since completed his thesis. A brief summary of the conclusions drawn from this research is intended to be included in the RNRP Annual Report 2015/16.

3.5 Analyse and report on the effectiveness of management techniques, and ensure that knowledge gained is transferred to the appropriate audiences to maximise conservation gain

Analysing and communicating technical information about the effectiveness of management techniques is a key learning objective, linking directly to national Mainland Island strategic principle two: "Results and outcomes are communicated". The RNRP has transferred information to target groups through various documents including annual reports, field trial reports, and occasional publications, as well as through presentations to technical audiences and input to periodic workshops and hui.

Following the implementation of the DOC restructure in spring 2013 it has been unclear whose role it is to maintain this technical communication. While biodiversity staff have collaborated to produce minimum required reporting (e.g. Annual Reports), the lack of clarity around biodiversity staff responsibilities following the disbandment of the RNRP-specific team, as well as the general reduction in staff resources following the restructure, has led to this objective continuing to lack the focused attention it requires.

Advocacy work continues to be carried out however, including presentations and guided walks. This is discussed in more detail in *section 4. Community objectives.*

Reports generated during 2014-15

No RNRP reports other than this Annual Report were produced by local DOC staff this year.

A progress report on the DOC Science & Capability project researching self-resetting traps was produced, which included an analysis and summary of data collected from the two-year A24 trial that was carried out in the RNRP over 2012-2014 (Gillies et al. 2014).

Hui, workshops, presentations and media articles

No technical presentations were held in 2014/15.

An article on wasps in Wilderness magazine featured comments selected from an interview with Nik Joice, Biodiversity Senior Ranger at Rotoiti/Nelson Lakes.

There were numerous Battle For Our Birds-related media releases, some of which included information about the Rotoiti BFOB operation.

Articles about activities within the RNRP and the wider Nelson Lakes National Park were also published in local and regional newspapers.

4. Community objectives

4.1 Foster relationships with likely partners to produce conservation gains within both the Mainland Island and the local area

The partnerships model further empowers DOC to look for more opportunities to work with a wider range of people and groups. Relationships with existing partners such as iwi, the Friends of Rotoiti and the Kea Conservation Trust are considered a high priority to maintain and continue to be built on, with new partners also being sought.

Friends of Rotoiti

The community group Friends of Rotoiti (FOR) was formed in 2001 by a group of conservationists who wanted to support the aims of the RNRP. Their effort is targeted to areas adjacent to the RNRP so that they are a line of defence against predators coming into the RNRP.

There are about twenty-five current volunteers who devote considerable time annually undertaking trapping, wasp control, trap building and maintenance, administration, planning and advocacy tasks. FOR members also contribute to developing more effective trapping methods (for example kea-proofing DOC200 stoat traps), participating in discussions and sharing ideas with DOC staff.

Volunteers attend two training meetings per year. This is a chance to learn new information from local DOC staff, and to keep their skills current. FOR continues to attract new volunteers and to maintain the trapping effort that supports the RNRP.

FOR Wasp control

A small group of FOR volunteers known as the 'Waspbusters' undertake wasp control using Permex around the village over the summer months.

They also assist DOC staff with the landscape-scale wasp control operation in the RNRP, in particular by filling wasp bait stations along the FOR Whisky mustelid trap line along the west side of Lake Rotoiti.

FOR village rat trapping programme

Trappers from the St Arnaud village continue to run a comprehensive rat trapping programme around the village.

Their work provides conservation gain by removing predators from the popular Brunner Peninsula Walk, Black Hill area, Black Valley stream and Brunner Peninsula residential area.

During this year all rat traps were modified. Coreflute tunnels were replaced by wooden tunnels and Victor traps were attached to 1.5mm rigid plastic slides to aid cleaning and prevent interference by weka.

Visitors to the DOC Visitor Centre comment on the FOR traps, giving staff an advocacy opportunity for conservation and the FOR group itself.

Table 14. Catches in Friends of Rotoiti rat trap lines, 2014/15

	Catch					
Trap line	Bird	Mouse	Possum	Rat	Stoat	Weasel
Black Hill Contour		157		64	1	
Black Hill Walk		223		66		
Black Valley Walk		584		161	1	
Cotterell Place		12		2		
Gibbs Walk		123		25		
Holland Street	2	155		54		1
Lodge Road		170		38		
Moraine Walk		355		10	3	
Peninsula Centre Line		171	2	62		1
Peninsula Nature Walk		978		209	1	6
Robert Road		109		52		
View Road		182		39		1
Ward Street		124		7		
Water Tank		171		21		
Total	2	3514	2	810	6	9

4.2 Increase public knowledge, understanding and support for Mainland Islands and ecological restoration nationally through education, experience and participation

The DOC national education strategy (*Education Strategy 2010-2030 - Investing in Conservation Education for a Sustainable and Prosperous Future*; DOC-722661) focuses on proactive, quality, education activities for young people, these being predominantly teacher-led and covering the curriculum.

Local DOC Community staff have undertaken a number of talks for school and community groups about the RNRP and conservation in 2014/15. These staff supported conservation advocacy at community events such as the annual Antique and Classic Boat Show at Rotoiti (where a display was created in co-operation with the Friends of Rotoiti and Fish & Game NZ), the Murchison A&P show, a kiwi release ceremony with Ngāti Apa ki te Rā Tō and Friends of Rotoiti, Kea Conservation Trust advocacy events and a Matariki event with the wider St Arnaud community.

Articles about activities within the RNRP and the wider Nelson Lakes National Park were also published in local and regional newspapers.

5. Discussion

The period covered in this Annual Report is the second season for the RNRP following the comprehensive restructure of DOC in spring 2013. Due to the heavy beech mast and the resulting Battle For Our Birds (BFOB) aerial 1080 operation, 2014/15 has been another challenging year, but the RNRP's core values have still been maintained. The RNRP therefore continues to be a valuable site for rigorous scientific testing of conservation techniques and tools, at the same time as protecting the biodiversity values of its honeydew beech forest ecosystem.

Nevertheless, the restructure has strongly influenced the management of the RNRP due to alterations to role descriptions. For example there is no longer an RNRP programme manager nor an RNRP-specific field team, instead management of the RNRP now falls within the scope of all Nelson Lakes biodiversity rangers' roles. The immense workload created for local DOC staff by the BFOB programme led to many other tasks being put aside for the duration of the pre-operation preparation and post-operation monitoring, including the task of clarifying who is now responsible for the different aspects of RNRP management within the new local structure. This remains an important issue to address in order for the RNRP to be well-managed.

Despite the pressures on staff created by the Rotoiti BFOB operation, there have been several successes in the RNRP this year. The two kea nests given protection from predators managed to fledge three juveniles each. The wasp control operation experienced very high bait take and reduced wasp activity to extremely low levels, resulting in a ~400% increase in honeydew droplets available to native fauna. A pig that had been causing ongoing disturbance in the Travers delta was dispatched. Possum monitoring indicates that control efforts are effectively keeping possum numbers low in the RNRP. Furthermore the BFOB operation itself was also completed successfully.

Research to inform biodiversity management throughout New Zealand remains a core focus of the RNRP. Since part of the RNRP was included in the Rotoiti BFOB aerial 1080 operation, the opportunity exists for the RNRP to move towards being a trial site for aerial pest control methods, rather than simply continuing to test ground-based methods as has been the focus in the past. Given that aerial pest control is likely to be increasingly used in South Island beech forest ecosystems such as is present in the RNRP, this seems a logical step to keep RNRP trials relevant in the changing world of conservation practices.

However, such trials are likely to require significant resources. A recurring theme through this Annual Report has been one of poor data resulting from a lack of resources to carry out monitoring to the planned or historic standard. If aerial pest control were to become a regular event in the RNRP, it would create the possibility to free up staff time by discontinuing labour-intensive tasks such as ground-based stoat control. Such changes do have the potential to lead to disgruntlement amongst the local community, RNRP visitors and other interested members of the public if they are not kept informed about plans, decisions and reasons behind those decisions, hence clear communication should be a priority. Careful thought needs to be put into the RNRP's potential contribution to future conservation research to ensure that the RNRP remains relevant, while abandoning neither the guiding principles and objectives that have served it well up until now, nor its long-term datasets that only become more valuable with each year.

The volunteer programme has played a crucially important part in the upkeep of the RNRP after staffing levels were reduced in the restructure, with volunteers essentially acting as extra staff members doing fundamental RNRP work rather than additional 'nice to do' work on the side. Throughout 2014/15 local Partnerships staff have been looking into the potential for expansion of the volunteer programme to provide additional resources in the future. The full immersion in DOC that volunteers experience gives those who are intending to work in the conservation field new skills and greater understanding of conservation in practice, as well as contacts within DOC which stand them in good stead for future employment.

The current RNRP Strategic Plan 2014-19 (Harper & Brown, 2014) captures the essence of DOC's change in strategic direction towards an increased focus on fostering partnerships to achieve conservation goals. Existing partnerships have been maintained and strengthened during 2014/15 and advocacy of biodiversity conservation to the public continues while potential options to develop new partnerships in the future are explored.

6. Recommendations

Relating to Rotoiti landscape-scale pest control/future Battle For Our Birds operations:

- Thoroughly consider the RNRP's potential contribution to future conservation research. Look ahead for opportunities for the RNRP to be involved in aerial pest control trials. Ideas for such trials include investigating:
    - The influence of swath width and other bait distribution factors on the success of aerial 1080 operations.
    - The efficacy of aerial 1080 for mouse control.
    - The influence of aerial 1080 on stoat-rat/weasel-mouse predator-prey dynamics and the interaction of these.

- When planning monitoring projects for pest control operations, if at all possible finalise treatment boundaries or at least predict likely buffers and exclusion areas before installing/relocating monitoring infrastructure and/or carrying out monitoring in areas that are likely to ultimately be excluded from the operation or do not represent the treatment areas adequately.

- If robin monitoring is carried out in the future then adequate staff resources need to be directed to the task to allow enough pairs to be located and a frequency of pair monitoring that provides reliable data (at least twice a week during a mast year). If cameras are used to monitor nests then time should be taken to ensure suitable camera placement.

- If an aerial pest control operation is done again at Rotoiti:
    - Aim to carry out the operation much earlier (July-August) to provide protection to native birds during the breeding season.
    - Aim to minimise reinvasion pressure by removing or reducing areas that were excluded in 2014 e.g. the Travers Valley flats.
    - Aim to include alpine areas, in particular around the known snail colony at the northern St Arnaud Range
    - Consider alternative options to hand-laying around sensitive areas, such as: treating the area aerially with a

higher level of track closure and clearing, aerial trickle-sowing, creating a buffer zone of traps, or simply having the treatment boundary be further away from the sensitive area, since hand-laying was found to require a lot of resources for limited benefit in the 2014 Rotoiti BFOB operation.

- Any future trials of a "diversion" approach to protecting "junk food" kea during aerial 1080 operations should consider investigating whether effort can be reduced without compromising kea health or diversion success, and whether the diversion area does reduce the likelihood of "junk food" kea ingesting 1080 pellets if those same kea are exposed to pellets in their foraging area.

Relating to other RNRP projects:

- Records should be kept of Catch per Unit Effort for different cat trap types in 2015/16 to allow a comparison that factors in the resources required.

- There is a possibility that fish frames are a more attractive bait than salted rabbit for cats. This should be trialled more rigorously in the future to determine the best bait to use for cat trapping in the RNRP. The dates of bait changes should be recorded.

- The RNRP hunting block system should be revisited to ensure that it meets Health and Safety requirements, and should be better promoted to the public to increase deer control effort.

- Regular pig control should be considered in areas within the RNRP where pig rooting activity is severe.

- Monitoring of re-located known kākā nest sites should be considered alongside the low-effort encounter rate monitoring in order to provide more information on the RNRP kākā population. Volunteers could potentially carry out the bulk of the monitoring, saving on staff time and providing regular volunteers with a project that does not revolve around trapping.

- More effort should be put into identifying and eliminating any remaining sources of lead in the areas surrounding the RNRP.

- A decision should be made on which of the two tussock monitoring methods is to be continued, and use of the other method ceased.

- External researchers should be actively made aware of, and encouraged to make use of, data collected in the RNRP.

- The Kiwi Call Count long-term monitoring scheme should be set up in the RNRP following Kiwis for Kiwi guidelines. This could potentially be a great project for the Friends of Rotoiti to be involved with.

- Erect an exclosure plot around part of the RNRP snail colony, for long-term monitoring into the impacts of hares and ungulates on the snail habitat. Ideally it should be large enough to fit a 20×20m vegetation monitoring plot within it.

- Locate and monitor the snail colony north of the currently-monitored population on the St Arnaud Range, in order to determine what impact five-yearly monitoring is having on the population.

7. Acknowledgements

The RNRP always relies on support from volunteers, temporary staff, and technical advisors, but in 2014/15 this reliance increased significantly due to the extra work arising from the Rotoiti Battle For Our Birds operation. The achievements in the RNRP this year could not have been realised without the assistance of many individuals.

We would like to thank the volunteers: Daniela Biaggio, Daniel Boettger, Kat Collier, Sarah Fisher, Elisa Gillet, Brett Halkett, Marissa Lelec, Quentin Lagaeyesse, Artur Oelhaf, Cara-Lisa Schloots, Wayne Sowman, Kerry White and all the Friends of Rotoiti; and the temporary staff: Graeme Andrews, Dan Arnold, Darin Borcovsky and Tarsh Bedford.

DOC staff from other areas provided essential help in carrying out the BFOB operation and associated work; in particular Robyn Crisford, Dion Fabbro, Terry Hatwell, Mike Hawes, Mark Martini, Joris Tinnemans and Rosie Willacy. Members of the RNRP Technical Advisory Group provided advice throughout the year (see Appendix 3 for a list of members).

We would also like to thank Bruce Waddell of Tasman Pest Control Ltd for taking on the role of site supervisor for the BFOB operation, Les Moran for assistance with re-locating kākā nests, Ron Moorhouse for providing tree-climbing training and Ralph Dickson of NIWA for providing cableway training to DOC staff.

Other DOC staff from the Rotoiti/Nelson Lakes area have supported the RNRP on many occasions, in particular during the intensive work on the BFOB operation. We are very appreciative of their assistance.

Finally we are very grateful for the work of dedicated Friends of Rotoiti volunteers Graeme Andrews, Drew and Marg Hunter, Wayne Sowman and Peter and Jackie Hale, whose commitment to the kea diversion project was unwavering over several months. This project could not have been carried out without them. We would also like to thank others who assisted with kea diversion area servicing on a more casual basis, as well as Tamsin Orr-Walker and Corey Mosen of the Kea Conservation Trust for their advice and assistance in making the project happen.

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Appendix 1. RNRP datasets

Datasets referred to within this report, and others that were maintained during the 2014/15 year, are listed below.

Introduced species

Dataset	File location	Contact person
Possum trapping	DOC-1437899	Pat van Diepen (pvandiepen@doc.govt.nz)
Possum monitoring	DOC-2514853	Pat van Diepen (pvandiepen@doc.govt.nz)
Wasp monitoring	DOC-1546039	Nik Joice (njoice@doc.govt.nz)
Kea protection trapping	DOC-1283015	Jenny Long (jlong@doc.govt.nz)
Mustelid trapping	DOC-1407000	Jenny Long (jlong@doc.govt.nz)
Cat trapping	DOC-586801	Jenny Long (jlong@doc.govt.nz)
Mustelid tracking tunnels	DOC-1501040	Jenny Long (jlong@doc.govt.nz)
Rodent tracking tunnels	DOC-2515711 and DOC-2689133	Jenny Long (jlong@doc.govt.nz)

Native species

Dataset	File location	Contact person
Five-minute bird counts	DOC- 769826	Jen Waite (jwaite@doc.govt.nz)
Beech seedfall monitoring	DOC-1365121	Nik Joice (njoice@doc.govt.nz)
Tussock monitoring	DOC-72336	Sandra Wotherspoon (swotherspoon@doc.govt.nz)
Great spotted kiwi	DOC- 747464	Jen Waite (jwaite@doc.govt.nz)
monitoring	DOC-1454781	Jen Waite (jwaite@doc.govt.nz)
Kākā monitoring	DOC- 171970	Jenny Long (jlong@doc.govt.nz)
Weka monitoring	DOC- 833080	Jenny Long (jlong@doc.govt.nz)
Snail monitoring	DOC-546239	Jenny Long (jlong@doc.govt.nz)
Pittosporum patulum monitoring	DOC-210952	Sandra Wotherspoon (swotherspoon@doc.govt.nz)
Robin monitoring	DOC- 1454750	Jen Waite (jwaite@doc.govt.nz)

Appendix 2. Battle For Our Birds documents

For a full list of 2014 Rotoiti BFOB-related documents, refer to the operation's home page (DOC-1485266).

Assessment of Environmental Effects	DOC-1449070
Compliance Register	DOC-1503295
DOC consent	DOC-1519797
Public Health consent (re-issued for Nov-Dec)	DOC-1520697
TDC resource consent	DOC-1508581
Communication plan	DOC-1449910
Operational plan	DOC-1498598
Tasks for Operational plan	DOC-1498969

Appendix 3. Project management

Non-BFOB RNRP budget

Staff (salary & wages): $193,228
Operating: $30,251

BFOB Rotoiti budget

(note this was provided from outside DOC Nelson Lakes budget, and operating costs were covered by national DOC budget)

Staff (salary & wages): $53,906

Staffing

Nik Joice, Jenny Long, Jen Waite, Gareth Rapley, Darin Borcovsky, Patrick van Diepen, Sandra Wotherspoon, Graeme Andrews.

Technical Advisory Group

Kerry Brown, Graeme Elliott, Craig Gillies, Dave Kelly.

RNRP advisors

Josh Kemp, Mike Hawes, Kath Walker.